

THE INDEPENDENT GUIDE TO **IBM** PERSONAL COMPUTERS



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Ink Jet Printers

IBM VS. Apple

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Hardware and Software
Similarities and Differences
Past and Future

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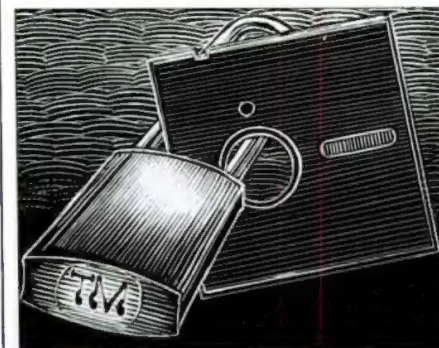
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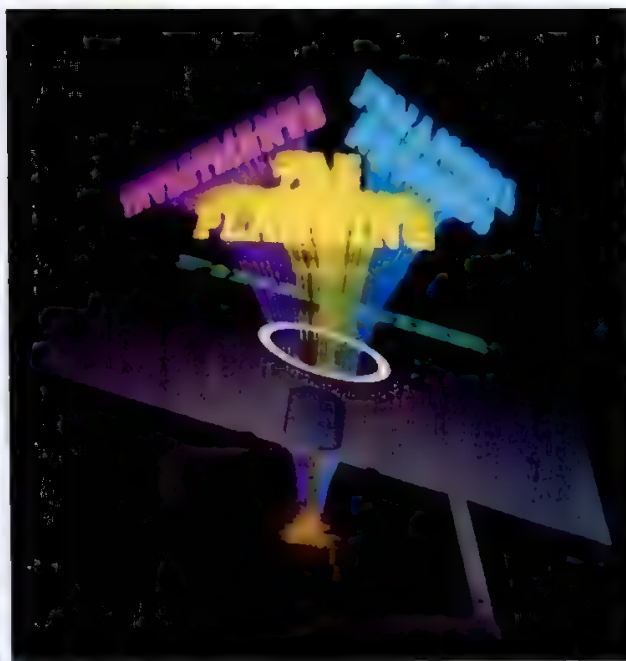


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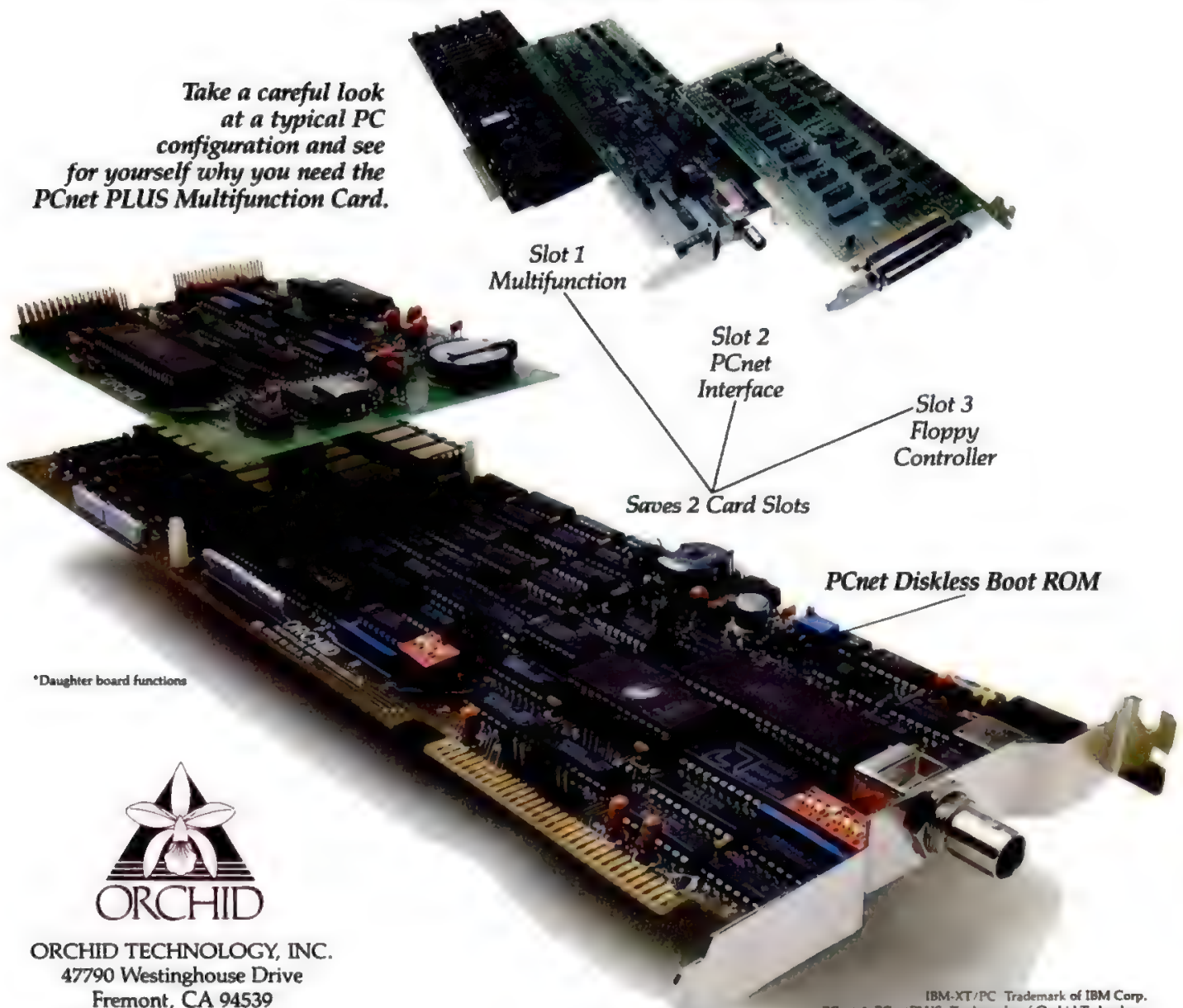
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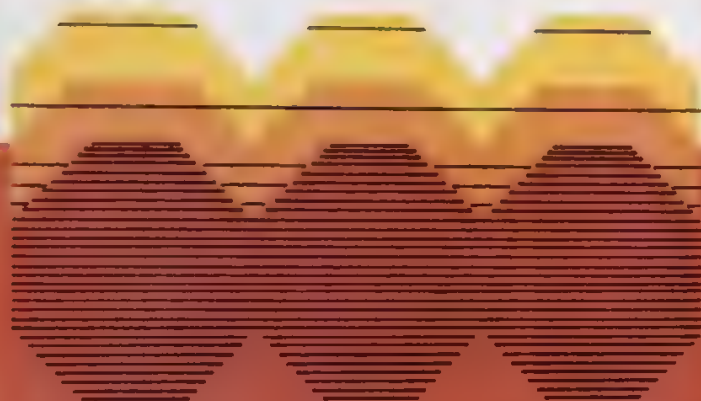
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PC Tutor makes learning easier, faster, cheaper.

Requires 64KB, 1 double-sided diskette drive, an 80-character display and MS-DOS.

Suggested retail \$59.95. See your PC dealer. Dealer inquiries welcome.



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Textra runs on the IBM PC and compatibles, and requires PC DOS (any version), 128K, and either monitor. Textra Jr. (\$39.95) requires 64K.



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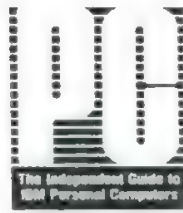
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CIRCLE 117 ON READER SERVICE CARD



What's Inside

In its cover package, PC analyzes the past successes and future potential of IBM and Apple as they battle for first place in the small business and personal computer markets.

Three years ago, Apple was the dominant name in personal computing. Today, IBM has matched—and many people feel has surpassed—Apple in importance as a maker and marketer of small business and personal computers. IBM's rise to the top of the microcomputing heap and the tense face-off that has resulted between IBM and Apple comprise our cover topic for this issue.

To some extent, Apple taught IBM how to sell personal computers: make the machine expandable, look for outside software support, tie into independent dealers. Big Blue had never done business this way before, and only Apple's meteoric success convinced IBM to try it. Paradoxically, Apple now seems determined to act less like its successful self and more like the old IBM—the Lisa, for example, is a shining example of proprietary, hubristic engineering and marketing. John and Barbara McMullen, who consult on both Apple and IBM systems for Wall Street, corporate, and governmental clients, examine the remarkable relationship between these two very different computer companies over the crucial past few years.

The differences between Apple and IBM are, in some ways, reflected in their personal computer products. In this issue, Alan Dziejma, an industry veteran and president of Business Solutions, Inc., dis-



cusses the philosophical differences in development between the IBM and Apple machines. He should know them; his first product, *The Incredible Jack*, was aimed at the Apple market; his latest, *Jack2*, is for the PC and XT.

And, what of the future? Computer industry prognosticator Robert Fertig traces likely paths for Apple and IBM personal computing. Who will win the hearts and minds of America's computing public? Fertig feels the question has not yet been answered.

Our cover package this issue also examines Apple-IBM linking products,

such as the Qudalink Board that allows Apple software to run on IBM hardware, and Alpha's Apple-IBM Connection for file transfers. Also, education writer Mary Ann Scarino looks into the crucial race for dominance in educational computing. It has always been Apple's mainstay; can IBM wrench it away?

Beyond the IBM-Apple arena, this issue tours many fascinating locales in the PC world. Special Projects Editor Paul Somerson takes a trip through IBM's huge PC operation nestled in the glens of Scotland, while contributing editor Jared Taylor reviews an amazing expert system for the PC, developed by Scottish scientists, that can help business leaders make better decisions. We also visit Airborne Express, where PCs keep track of all those overnight packages, and Trinity Hospital in Houston, which uses PCs to run its emergency cardiac care unit.

Our hardware reviews this issue include Mark Zachmann's look at the very colorful new crop of ink-jet printers and new contributor Stephen Smith's review of the Chameleon, a nifty compatible with 8-bit CP/M thrown in as an extra attraction. And, on software, we look at four word processors and a text formatter designed especially for screenwriters, as well as a package for landlords.

With IBMs, Apples, and all the rest, we feel this is quite a fruitful issue. ■

The new 384K Quadboard by Quadram is the most comprehensive board you can buy for the IBM PC or XT. Now with added hardware features and advanced software. But our same low price.

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a Serial Port, too. Fully programmable, use it to connect to plotters, modems, and other serial devices.

- **Chronograph:** And Quadboard's Chronograph (Real-time clock/calendar) keeps your system's clock up-to-date.

- **Game Port:** The new Quadboard has an IBM compatible Game Port. Plug in a joystick or game paddles, and fire away.

- **I/O Bracket:** Quadboard now comes with a special I/O bracket. Use it to organize your expansion port connectors. Snaps right onto the back of the PC.

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• **Expandable to 384K:**

The new Quadboard is expandable in 64K increments for up to 384K additional RAM. With full parity checking standard. With the new Quadboard and a fully populated system board, you can take your PC's memory up to the 640K limit.

• **QuadRAM Drive:** Plus, with Quadboard you get advanced QuadMaster Software. Including the QuadRAM Drive program. Use it to set up multiple RAM Drives in Quadboard memory. Solid state drives that let you store and retrieve data quickly and easily. Or take advantage of QuadMaster disk caching. To access frequently

used data whenever you need it.

• **MasterSpool:** QuadMaster Software also includes MasterSpool. Use it to set up a software print buffer quickly and easily. This advanced spooler lets you pause at any time, back up or move forward in a file. Choose just the amount of buffer space you need and stop waiting on your printer.

• **Qswap:** Another feature of QuadMaster Software is Qswap. With Qswap change line printers 1 and 2 back and forth, with just a few keystrokes, as often as you like.

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Features/ Functions	Quadboard	SixPakPlus
Memory Available	0-384K	0-384K
Parallel & Serial Port	Yes	Yes
Clock/Calendar	Yes	Yes
I/O Bracket	Standard	Optional
Game Port	Standard	Optional
Diagnostic Testing	Yes	Yes
Advanced Spooler	Yes	No
Simple Menu Setup	Yes	No
Disk Cache	Yes	No
LIST PRICE WITH 384K*	\$795	\$970

*Manufacturer's suggested list price for board with all available features/functions as shown (options included). SixPakPlus is a trademark of AST Research Inc.



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CIRCLE 327 ON READER SERVICE CARD

BY QUADRAM

Computer stores were full of programs for the COMPAQ Portable before there was a COMPAQ Portable.

Here's why.

The COMPAQ™ Portable Computer runs more programs than any other portable computer. In fact, it runs more than most non-portable personal computers.

All of the popular programs written for the IBM® Personal Computer will run on the COMPAQ Portable. There are hundreds of them, available at computer stores nationwide. And each one is more productive when you run it on a portable personal computer.

With the COMPAQ Portable you get portability and you don't sacrifice performance.

True compatibility

A lot of computer manufacturers claim their computer is compatible with the IBM Personal Computer.

Well, there's compatible and there's compatible.

In a lot of cases, "compatible" means the computer will run IBM programs *after* you spend time and money making modifications to the computer, or the program, or both.

The COMPAQ Portable runs all of the popular programs written for the IBM Personal Computer just the way

The COMPAQ Portable runs all the popular programs written for the IBM Personal Computer. Even the user guides can be used right off the shelf.

they come out of the package. As is. No modifications whatsoever.

Find out, "What if...?"

The COMPAQ Portable runs all the popular spreadsheet programs. With them, you can do a better job of almost any task you now do with pencil, paper, and calculator. Create a budget, a plan or a cost analysis. In minutes you can do updates that normally take hours. You can examine several different alternatives in less time than it would take to do a single problem by hand. You can answer questions you didn't even have time to ask before.

You can spend more time thinking about your business and less time crunching numbers.

Money management made portable

With the COMPAQ Portable you can take advantage of a variety of financial

With available communications programs and optional boards, the COMPAQ Portable can give you access to a variety of central computer files. Business information wherever you go.

programs for full-scale professional money management.

Receivables programs tell you who owes money, how much and since when. Payables programs give you tighter control of outgoing cash. General ledger programs can record financial histories and pull together income statements and balance sheets. Payroll programs keep records, calculate deductions, and generate checks. Inventory management programs help you hold down inventory investment.

With the COMPAQ Portable you can take computerized accounting wherever you need it and keep closer contact with your company's financial status.

Word processing to go

Would a word processor make you more productive? Then imagine the power of a *portable* word processor.

Choose from a wide variety of popular word processing programs to meet your specific writing need.

With word processing programs and an optional printer you don't have to



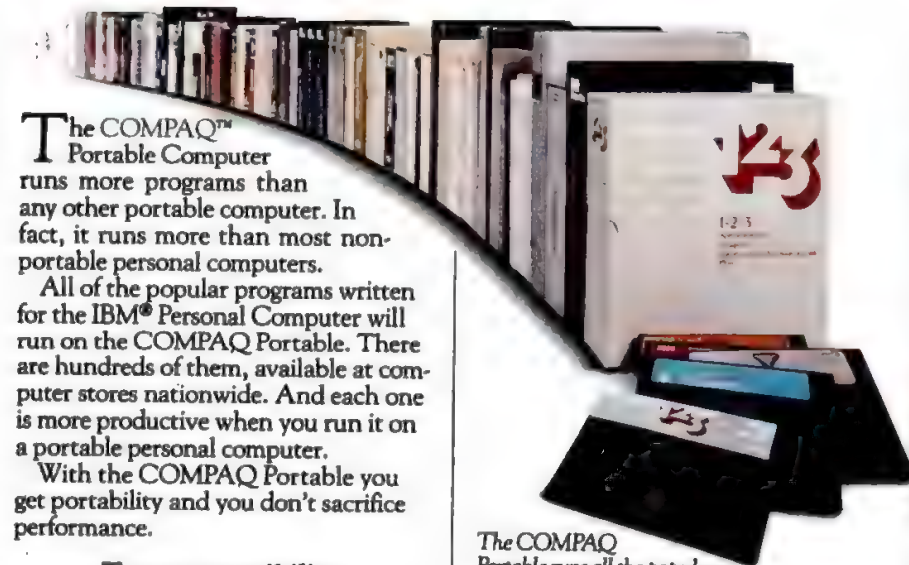
The COMPAQ Portable runs popular programs for designing color charts and graphs that can enhance your business presentations.

start fresh when you need to make revisions. You can change formats, move paragraphs, and automatically search for the parts that need to be updated. The COMPAQ Portable even runs programs that can check your spelling.

In other words, you can work smarter—not harder.

Computer conversations

The COMPAQ Portable can handle computer-to-computer communications.



There are a number of communications expansion boards and programs available that can keep you in touch.

Some allow you to use the COMPAQ Portable to access a variety of central computer files over the phone. You can have headquarters information wherever you travel.

With others you can retrieve late news or stock prices from data banks covering thousands of topics.

Others enable you to send electronic mail. Across the hall or across the country.

And the COMPAQ Portable can be equipped to link with both local and wide area networks of compatible computers so everyone in your company can work with the same information.

All these expansion boards, and others, will fit into any of three expansion slots in the COMPAQ Portable. The slots accept the popular IBM-compatible boards so your COMPAQ Portable can grow to keep up with your changing needs.

A world of business information is available wherever you and the COMPAQ Portable go.

...and lots of others

There are programs for designing graphs and charts, programs for keeping track of complicated schedules, and programs for electronic filing. There are powerful integrated programs that allow you to perform several different tasks

Specifications

Software

- ☐ Runs all the popular programs written for the IBM PC

Memory

- ☐ 128K bytes RAM
- ☐ Expandable to 640K bytes

Storage

- ☐ One 320K byte diskette drive, second drive optional

Display

- ☐ 9-inch (diagonal) monochrome screen
- ☐ 25 lines by 80 characters
- ☐ Upper- and lowercase, high-resolution text characters
- ☐ High-resolution graphics

Expansion board slots

- ☐ Three IBM PC-compatible slots

Interfaces

- ☐ Parallel printer interface
- ☐ RGB color monitor interface
- ☐ Composite video monitor interface
- ☐ RF modulator interface

Physical specifications

- ☐ Totally self-contained and portable
- ☐ 20"W x 8½"H x 16"D



Even the most productive program is more efficient when it's used on a portable.

after entering your data only once.

The wealth of programs combined with the convenience of portability makes the COMPAQ Portable the most useful personal computer of all.

Ready to go

The COMPAQ Portable is big where it counts.

The display measures nine inches diagonally and shows a 25-line-by-80-character page that's easy to read even if you're leaning back in your chair. The keyboard is typewriter-like for ease of use and detached so it can fit the most comfortable working position.

Truly portable means tough enough for the road, and the COMPAQ Portable is. Electronic components are surrounded by a sturdy cross-braced aluminum frame. Disk drives are secured by unique rubber shock mounts. The outer case is made of LEXAN®, a polycarbonate plastic used to make bulletproof windows and faceplates for space suit helmets.

Truly portable also means ready to go without a lot of preparation. You can have the COMPAQ Portable ready to move in less time than it usually takes to pack your briefcase.

The added usefulness is free

The COMPAQ Portable works the way desktop computers do, but in more places. Yet it doesn't cost any more.

In fact, the COMPAQ Portable costs less than a comparably equipped IBM or Apple® III. The COMPAQ Portable comes standard with one 320K byte diskette drive and 128K bytes of memory. A second diskette drive and additional memory are available.

The bottom line is this—you just can't buy a more practical, useful, productive computer.

For the location of the Authorized Dealer nearest you, call 1-800-231-0900.

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Requires MS-DOS, any IBM Personal Computer or Compaq Personal Computer with at least one diskette drive and a monochrome or color display. Phone and dealer inquiries welcome.

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Word processing so smart it can even spell 100,000* words.

Meet the BOSS. WordPlus-PC's incredible
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WORD PROCESSING AND SPELLING COMBINED:

WordPlus-PC featuring the "BOSS" is a whole new technology in word processing software. Finally, the most powerful word processing capabilities have been combined with a built-in electronic spelling system which not only *checks your spelling* but also *corrects your spelling*.

The "BOSS", an acronym for Built-in On-line Spelling System, eliminates embarrassing spelling errors in your letters and stops time consuming trips to the dictionary.

But WordPlus-PC featuring The "BOSS" will do far more than just check and correct your spelling. It's been designed to be exceptionally easy to use and yet contain all the powerful features you expect and more. Like built-in mail merge for personalized form letters, invoice generation and the ability to merge information created by most other popular programs such as 1-2-3™ and dBASE II™. And if you have a question, just press the HELP key to get back on track.

You can also print bar graphs and other charts,* easily move columns, scroll horizontally, execute global search and replace, boilerplate text, and even print proportionally spaced on selected printers. And WordPlus-PC is compatible with virtually all popular letter-quality and dot matrix printers.

*With 90,000+ word standard dictionary and ability for a user to add over 10,000 "custom" words.

HERE'S HOW THE BOSS WORKS FOR YOU:

IT CHECKS

Thank you for your interest in WordPlus-PC. The acronym for WordPlus-PC's new Built-in On-line Spelling System, the BOSS, automatically corrects any misspellings. This new technology and its from Professional Software, Inc. offers an option that lists a correct spelling of that word - in order of how you don't even have to type in the word that number of your selection, and the misspelled word.

At the touch of a button, virtually anytime during typing or after the creation of a document, The "BOSS" locates and **highlights misspelled words** on your screen. The "BOSS" can even check the spelling of a word directly after it's been typed in.

IT SUGGESTS

Thank you for your interest in WordPlus-PC. The acronym for WordPlus-PC's new Built-in On-line Spelling System, the BOSS, automatically corrects any misspellings. This new technology and its from Professional Software, Inc. offers an option that lists a correct spelling of that word - in order of how you don't even have to type in the word that number of your selection, and the misspelled word.

When a word is misspelled, the user can ask The "BOSS" for suggestions as to how to correctly spell the word. With only one keystroke, The "BOSS" will display, in a dynamic on-screen window, up to eight spelling suggestions in the order of probable phonetic correctness.

IT CORRECTS

Thank you for your interest in WordPlus-PC. The acronym for WordPlus-PC's new Built-in On-line Spelling System, the BOSS, automatically corrects any misspellings. This new technology and its from Professional Software, Inc. offers an option that lists a correct spelling of that word - in order of how you don't even have to type in the word that number of your selection, and the misspelled word.

And The "BOSS" Auto Correct feature enables users to "fix" these misspelled words directly in text with a single keystroke. The "BOSS" is a total spelling system that Checks, Suggests, and Corrects your Spelling. All built-in.

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With over 70,000 word processors in use worldwide, Professional Software, Inc. has designed WordPlus-PC to contain all the powerful features you expect — and to be the easiest word processor to use anywhere. But there will always be questions. That's why

Professional Software has an entire bank of Nation-wide TOLL FREE customer HELP lines to support our registered users. This service is available at No Charge during the 90 days following the receipt of your registered user card.

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Visit your local professional computer dealer or call us toll free for the dealer nearest you. Once you witness the BOSS in action, you'll see that all other word processors have become totally obsolete.

Demand to see the "BOSS" today! Call us toll free, 1-800-343-4074.

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Specifications are subject to change without notice.

WordPlus-PC was designed and written by Andres Escallon.
*With IBM dot matrix and Diablo 630 ECS printer,
bar graphs and other charts can be printed inside text.



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The TAX STRATEGIST tells you how much shelter is right for your financial situation. It helps you plan strategies for reducing your tax liability.

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The Tax Strategist and the Investment Strategist are available through authorized IBM Personal Computer dealers nationwide. Visit one and ask for a demonstration. It will be one of the best investments you'll ever make.

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		Box of Ten Each Disk	Box of Ten Each Disk	Box of Ten Each Disk	Box of Ten Each Disk	Box of Ten Each Disk	Box of Ten Each Disk
5-1/4" single-side, single-density, soft sector	Apple II, Commodore, Radio Shack TRS-80	54256	\$2.47				
5-1/4" single-side, double-density, soft sector	IBM PC (single-side), Apple II, Commodore, TRS-80 Model III	54968	2.47	54974	\$2.81	MD525-01-18158	\$2.66
5-1/4" double-side, double-density, soft sector	IBM PC (dual side)	54624	3.50	54980	3.74	MD350-01-18188	4.10
8" single-side, single-density, soft sector IBM Format 2305830	Radio Shack TRS-80 Model I	53428	2.55	54998	3.06	FD34-1000-3718	2.66
8" single-side, double-density, soft sector	Radio Shack TRS-80 Model II			54021	3.23	FD34-8000-18137	3.40
Description		Part Number		1 to 4 Cases		5 to 9 Cases	
5-1/4" Library Case		Mini-K/10		\$2.50 Each		\$2.00 Each	
8" Library Case		KA5/10		3.94 Each		3.15 Each	
Cases sold only with another item.						10 or More Cases	
Description		Part Number		Number Per Box		Exact Price Per 1000	
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One Part 1/2" Green Bar		14112GBMP-15		1500 Sheets		\$16.04	
9-1/2" x 11", 80-Column Fanfold Paper, 1-Right & 1-Left Vertical Perforation-Tractor Holes on Both Sides							
One Part Blank		9510PPMP-15 lb.		1500 Sheets		\$11.68	
Nashua Line Printer Labels-Pressure Sensitive							
3-1/2x15/16 White One Up-One Wide		10350-1		5000 Labels		\$2.60	
3-1/2x15/16 White Four Up-Four Wide		10350-4		20,000 Labels		2.60	

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CIRCLE 318 ON READER SERVICE CARD

What's on the best-seller list in IBM Personal Computer software?

Games can make anyone
a winner while treating
you to hours of fun
and fantasy.



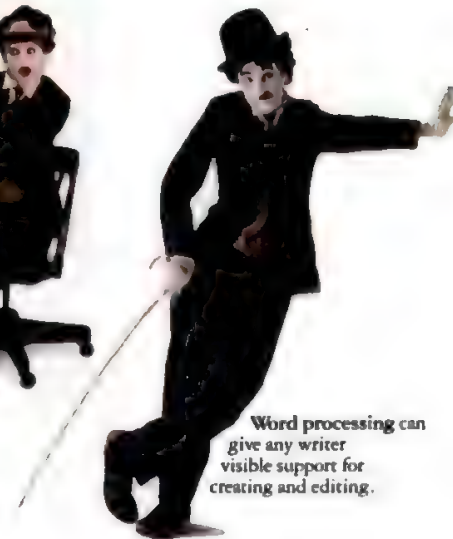
Payroll can boost your
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deductions less taxing.



Electronic spreadsheets help
build financial models that
can shape your future.



Word processing can
give any writer
visible support for
creating and editing.



Inventory control can help put you on top by keeping track of what's what and where.



Languages like BASIC can encourage students to write programs of their own.



Stock monitoring can help put you in the chips by tapping the world of Wall Street.



Data management can help tame your file of names, numbers, facts and figures.



Accounting can give you a leg up when balancing the books.



People prefer IBM Personal Computer software for a variety of reasons. And one of the best reasons is its variety.

Because, for just about anything you want the IBM Personal Computer to help you do, there's software to help you do it. Software to help improve productivity, efficiency and planning. To help teachers teach and students learn.

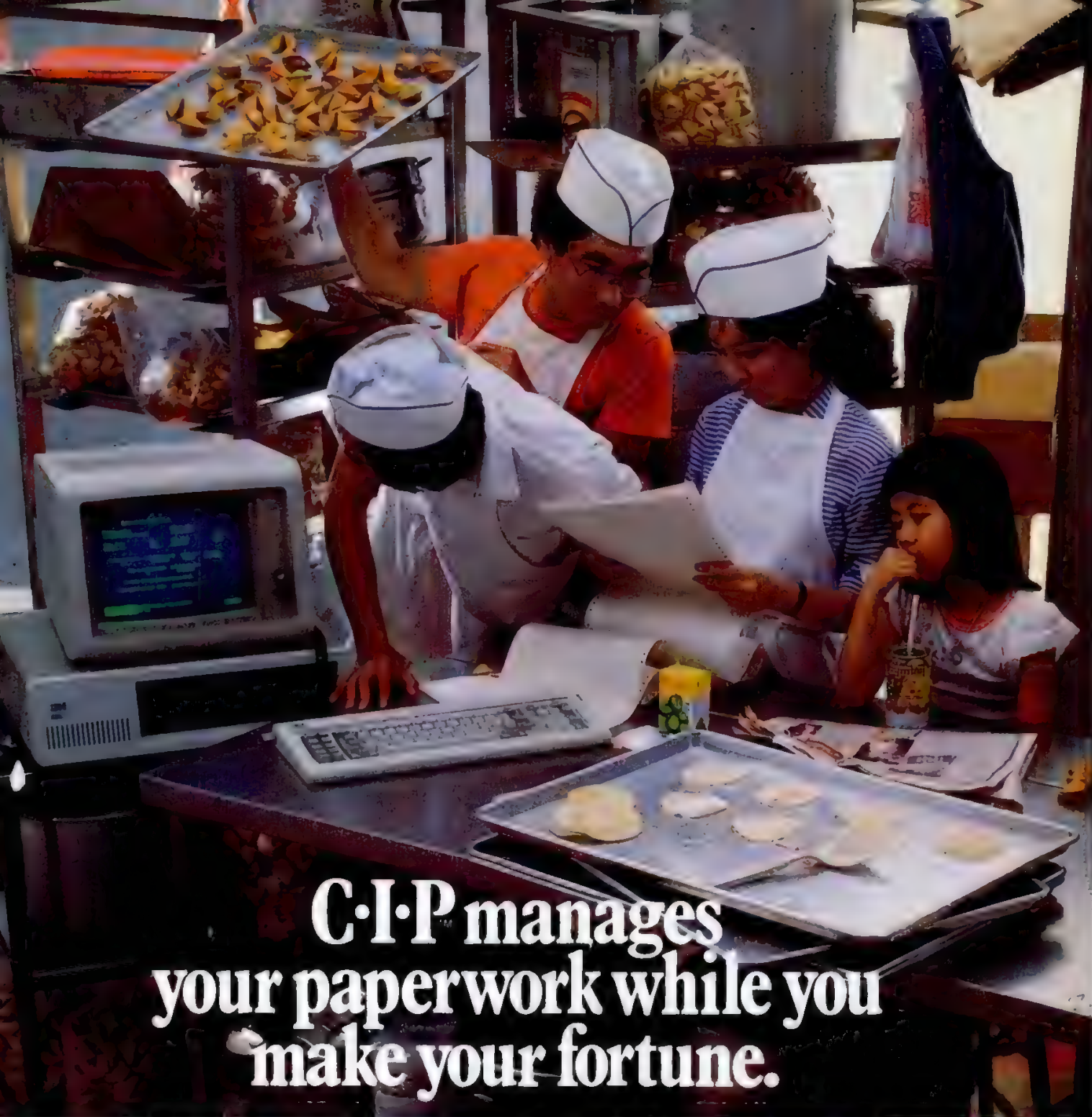
Or help you become an even more astute gamesplayer.

Every program in our software library makes the IBM Personal Computer a truly useful tool for modern times. That's why a lot of buyers like you have made them best sellers. And the library is still growing.

So the best may well be yet to come.

IBM

For more information on where to buy IBM Personal Computer software and hardware, call 800-447-4700. In Alaska or Hawaii, 800-447-0890.



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changes in your business and the power to grow along with your needs. • Ask your local IBM PC dealer to show you how C-I-P can keep inventory under control, manage mailing lists, write reports, calculate due dates, figure sales tax – in other words, take over the paperwork, while *you* concentrate on running the business and increasing profits. C-I-P from Concentric Data Systems, 18 Lyman Street, Westboro, MA 01581, (617) 366-1122.



CIRCLE 101 ON READER SERVICE CARD

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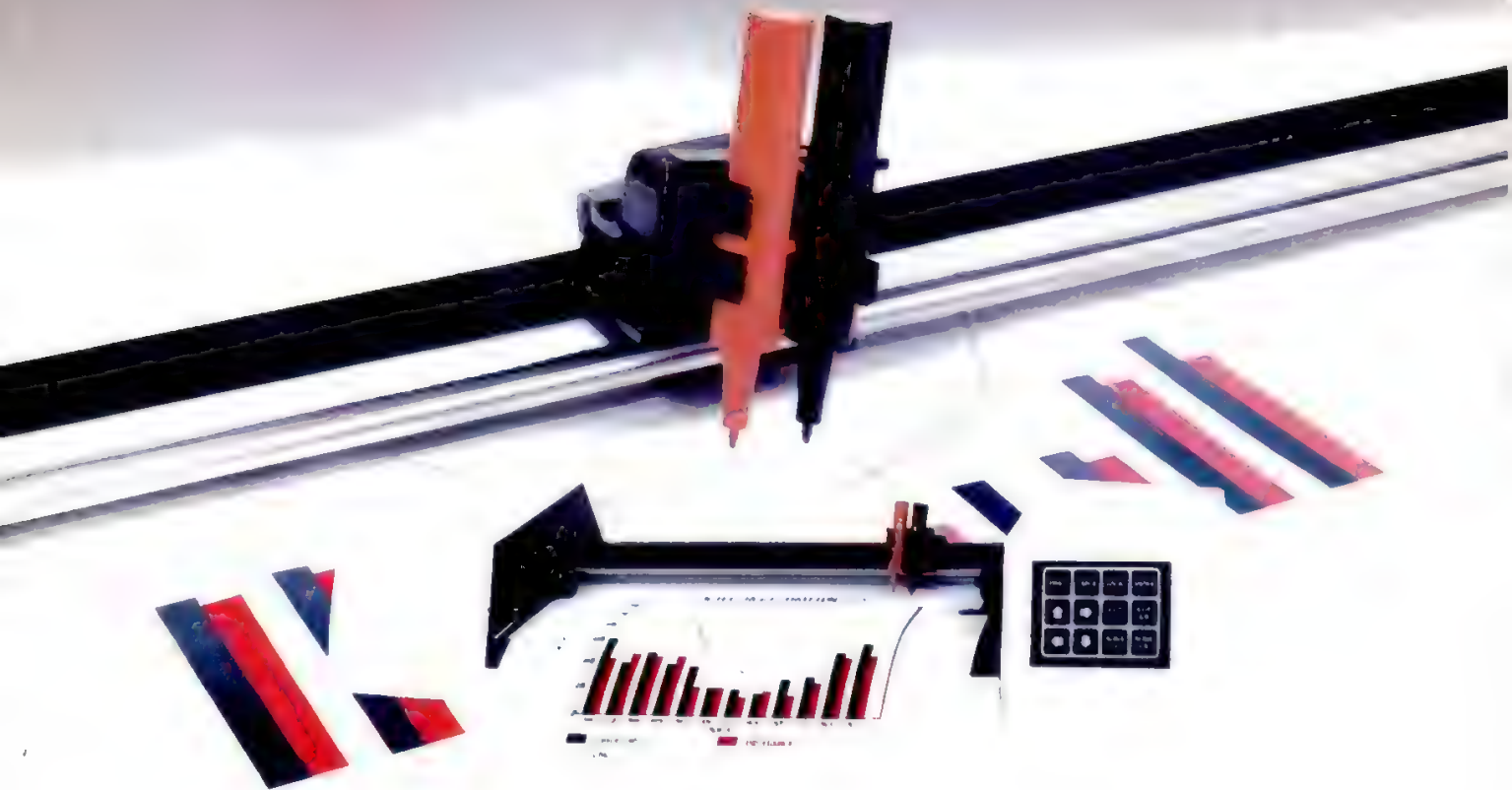
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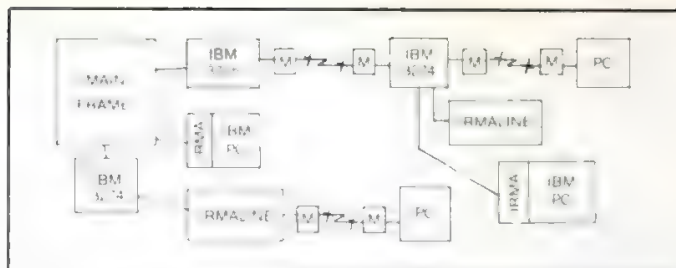
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IBM News

FROM THE EDITORS OF PC

FEBRUARY 21, 1984

In Computer Retailing, Bad Goes With Beautiful

Will "gas station on every corner" mentality spoil the booming hardware market?
Are software margins too low for big profits at specialty shops?

BY KAREN COOK

NEW YORK — There's good news for computer retailers: Sales of computers and peripherals will increase 30 percent annually over the next 5 years, from \$12.4 billion in 1983 to \$47.5 billion in 1988, according to Future Computing, Inc. The personal computer market research firm, near Dallas, says the outlook for software sales is even brighter. Software sales, increasing at 41 percent a year, should leap from \$2.1 billion in 1983 to \$12 billion by 1988. Furthermore, Future Computing predicts, a large chunk of the expanded software market could go to a new breed of computer store: the software specialty shop.

In the computer industry, however, good times mean volatile times. Even as computer sales boom, experts are warning that the number of computer retailers may have reached a saturation point. "It's approaching the level of



A software specialty store: lots of bustle, but are the margins high enough?

a gas station on every corner. When that happens, there's got to be an end to it," says William Coggshall, president of Software Access International, Inc., a Mountain View, California, micro-computer research firm. Software specialty shops, he believes, may face even more difficult times.

There are currently about 300 software-only stores in the United States, only one-tenth as many as there are hardware-oriented shops.

Software shops account for only 1 percent of software sales, with the bulk of business going to mail order houses or general computer dealers.

Those figures may be changing, however: Future Computing guesses that software specialty shops could have 28 percent of the market by 1988, and several software specialty operations have announced big plans to expand in the next few years. "If anything, the Future

Computing figures are conservative," says Taylor R. Coleman, president of Softwareland Corporation, a Scottsdale, Arizona-based chain that recently got \$4.5 million in venture capital funding to build its stores on.

Many industry analysts are less optimistic. Aaron Goldberg, research manager for International Data Corporation (IDC) in Los Angeles, puts it bluntly: "Purely non-value added retailing of software is a strategy for the poorhouse," he says. As a result, according to one computer retailer, "most software only stores end up selling hardware under the counter. They enter the gray market."

Non-value added retailing is the kind of selling that gets done in bookstores or supermarkets—places where there are many goods to choose from, but little sales help or extra service provided by the store.

(continued)

Retailing (continued)

According to Goldberg and other analysts, non-value added retailing is one of two marketing strategies the software dealers have to choose from: Either they can sell software packages at relatively low price—in which case they can expect low margins and will probably not be able to offer extensive sales support—or they can sell and train people to use expensive, specialized packages. With the second strategy, retailers have lower volume and higher overhead than with the first, but the profit margins are higher with customized software.

Software retailing offers several advantages over hardware retailing: Software is easier to distribute than heavy, fragile machines, and less often in short supply; it also costs much less to build up an inventory of software than it does to buy computers.

Selling software from a storefront is a more expensive proposition than it at first appears, however. Even though margins on software packages average 35 percent, store owners must pay rent and wages and purchase computers for giving software demonstrations.

"If I sell one \$4,000 machine a day in a computer store, and my margin is 30 percent, I still have \$1,200 gross profit. But if I sell two things in a software store and they are \$400 packages that I make 40 percent on, I still only made \$320 gross profit on the day," Goldberg says.

Goldberg believes software stores that offer extensive training programs or that will tailor software to customer needs have a



Even in "software only" stores, books and supplies account for half the dollar volume.

chance of survival. However, it may take a while before computer users are willing to invest large amounts in expensive software.

"The best selling retail software is less expensive software," Goldberg says. "People have a hard time assigning a lot of value to intangible objects, and software doesn't seem to be worth anything. People don't want to go to software stores and pay list price when they could send away to mail order houses and save \$300."

Software shoppers might also go to large bookstore chains, which may soon add software to their shelves, or acquire software through various methods of electronic distribution, either in stores or at home.

Coleman of Softwareland isn't worried that bookstores will get much of his business. "They will only be selling the top ten, well-known packages, and they won't support them," he says.

Coggshall of Software Access remembers that "in earlier experiments in the bookstores they never sold a copy of *VisiCalc*." Since business and accounting

packages represent the fastest growing and highest priced segment of the software market, "that may help the software-only stores," the analyst says.

Widespread and effective electronic distribution is probably several years in the future. "It makes great cocktail party conversation," scoffs Coleman. "But how are they going to download increasingly large, complex programs? How will they distribute documentation?" Even Coggshall, who thinks electronic distribution is promising, admits he hasn't seen a "practical" system—yet.

So far, reports from the software retailing field are mixed. Software Centre International, founded in Los Angeles in 1981, now has 53 stores in 20 states and claims to be the largest software retailing chain. It also has one prestige contract: Software Centre will be providing software for the U.S. government's new General Services Administration (GSA) computer supply stores.

Softwareland started out with a big splash at Comdex (a dealer's convention) in the spring of 1983, but quickly

got embroiled in a suit with ComputerLand over trademark rights to the word "land" in its name. That suit is still dragging through the courts. ("Justice delayed is justice denied," says Coleman.)

Softwareland has fewer than ten stores in the Southwest, but Coleman still insists the company will have several hundred franchised stores by the end of 1986. "You have to give the customer base time to develop," Coleman says. "The market for software is 4 to 6 years behind the market for hardware, but it's taking off now."

Even so, Coleman concedes that more than half of his revenues come from non-software items: magazines, books, paper—and gray-area peripherals, like printers and plotters.

For computer retail stores that emphasize hardware, too, opportunity is accompanied by risk. Future Computing identified 3,152 full time computer stores at the end of 1983, up from 2,479 in the second quarter. Counting retailers that sell computers as a sideline and franchise stores that have been paid for, but not yet opened for business, the number of stores could be closer to 5,000.

"In some areas, you see four or five computer stores on the same block," says Goldberg, who likens the computer business to the stereo business in 1975—the year before it went bust. "There was a tremendous fast-growth period in hi-fi," Goldberg recalls. Then the market matured, a number of large chains went out of business or reorganized, and

sales dropped. "I think that's a phenomenon we're going to see again," he says.

Future Computing classifies computer dealerships in four different categories: single-location independents (the "mom and pop" operations); multi-location independents (company-owned chains, but without national marketing plans); company-owned chains, which include Businessland and Sears Business Systems Centers; franchise operations, like ComputerLand and Entré; and computer manufacturer-owned chains, like IBM's, DEC's, and Tandy's Radio Shack stores.

Of these groups, multi-location independent stores and single-location independent stores are the least known and the most watched. Together they make up almost 40 percent of the market, but both slipped some in 1983. If the marketplace is glutted, stores in these categories will probably feel the crunch first: If competition or costs increase too much, single or even multi-location independents may join franchises, sell out to company chains, or simply fold.

Franchises make up the biggest segment of the retail market, and they moved up from 21.9 percent of the market in the second quarter of 1983 to 25 percent by year end, according to Future Computing. They did so largely on the strength of ComputerLand and Entré, which are adding 10 to 12 stores a month each.

ComputerLand, (Hayward, California), with about 600 stores and over \$1 billion in sales, is rolling in cash these days, according to

knowledgeable observers. Entré Computer Centers, Inc., the second largest franchise, is still climbing despite its 127 stores. Over half of that 2-year-old company's \$8 million in sales in fiscal 1983 came from a combination store and market research center in its McLean, Virginia, headquarters. Only 26 percent of revenues came from the royalties franchises sent in. Another 19

percent of sales came from one-time only franchise fees. Entré went public in December, raising some \$10 million from sales of stock.

Although they make up only 12.5 percent of the market, "there has been a real push in company-owned chains to increase the number of locations," says Alice Brown, vice president for Future Computing's retail market group. Instead of

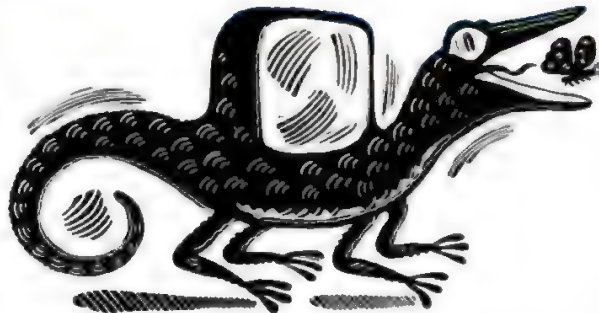
having franchisees paying for each new shop, companies must support expensive new stores with their own capital. By nature, then, they grow more slowly than franchise operations. "We prefer it this way," says Suzie Crocker, director of communications for Businessland, Inc. "We can maintain quality control and we can attract good people by promising them a future in the organization," she explains.

Company-owned chains can be distinguished from mere multi-location independents by their ambition, says Brown of Future Computing. As an example, she cites Houston-based ComputerCraft, Inc. The firm started with only a couple of stores, expanded throughout Texas, and recently opened a store in Memphis. "They have definitely become a company-owned chain because they have a central negotiating point with multiple locations and a very aggressive stance for future planning," Brown says.

Another fast mover is CompuShop, Inc., with 40 stores. Joe Harmon, vice president for merchandising, says that careful distribution is the key to his company's growth. CompuShop tries to open new stores along what he labels wide-bodied jet routes, so that new equipment can be delivered from the company's Dallas headquarters' warehouse at reasonable freight rates. Harmon refuses to divulge more strategy than that.

The company-owned chain with a difference is Businessland, which has opted toward a complete service for the business com-

Disk of Horrors



We've heard variations on the following horror story so often that it may be the computer age's equivalent of rumors about alligators in New York City's sewers. Richard Melucci, of South Setauket, New York, claims that it really happened to him, so gather around the campfire and listen closely to his tale...

"It was a hot and muggy night. I had been working for hours on a BASIC program with my Seequa Chameleon (an IBM PC-compatible portable). I took a short break—about 15 minutes—and returned to the machine, made a few more revisions, and told the computer to save the file. Its response was, 'Disk read error. Abort Retry, or Ignore?'"

"I was mad! This always happens to me. I tried putting in a fresh disk. Same result. Then the computer evicted me from BASIC—my revisions were gone!"

"I tried a more desperate solution: I turned the computer off and waited a few seconds. When I turned it back on I was greeted by Cassette BASIC. I turned it off and tried again. Still Cassette BASIC. Why wouldn't my disk drive reboot?"

"I opened the A: drive's door and cautiously pulled out the system disk. I looked at it in shock—there on its hub ring was the remains of a smashed insect! What if the rest of the creature was splattered all over the disk drive's delicate head?"

"I crossed my fingers, then inserted a clean copy of the system disk. I pressed Ctrl...Alt...Del...HOORAY! My machine had returned safely from the twilight zone."

We're glad there was a happy ending to Richard Malucci's suspenseful story. As students of nature, though, we're not surprised that a Chameleon would try to swallow a bug. ■

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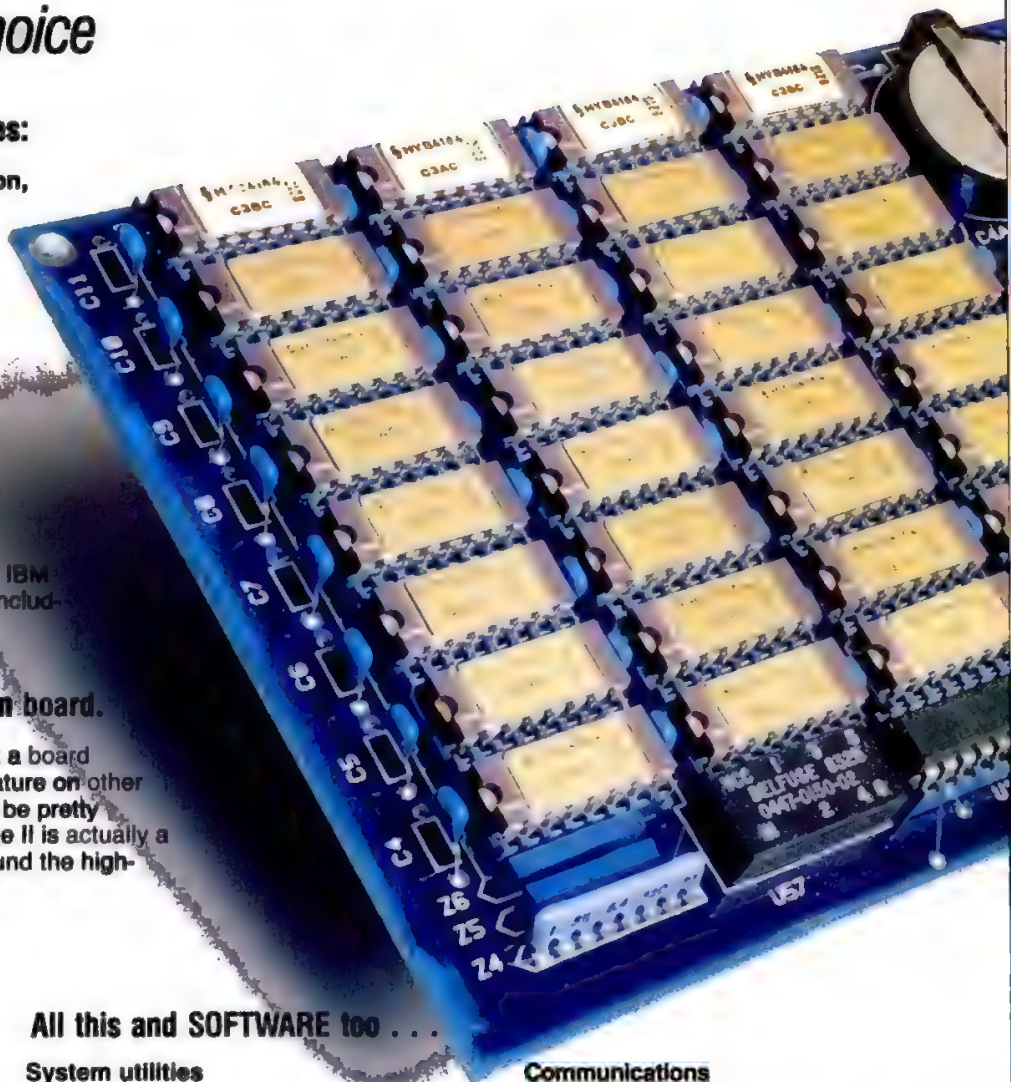
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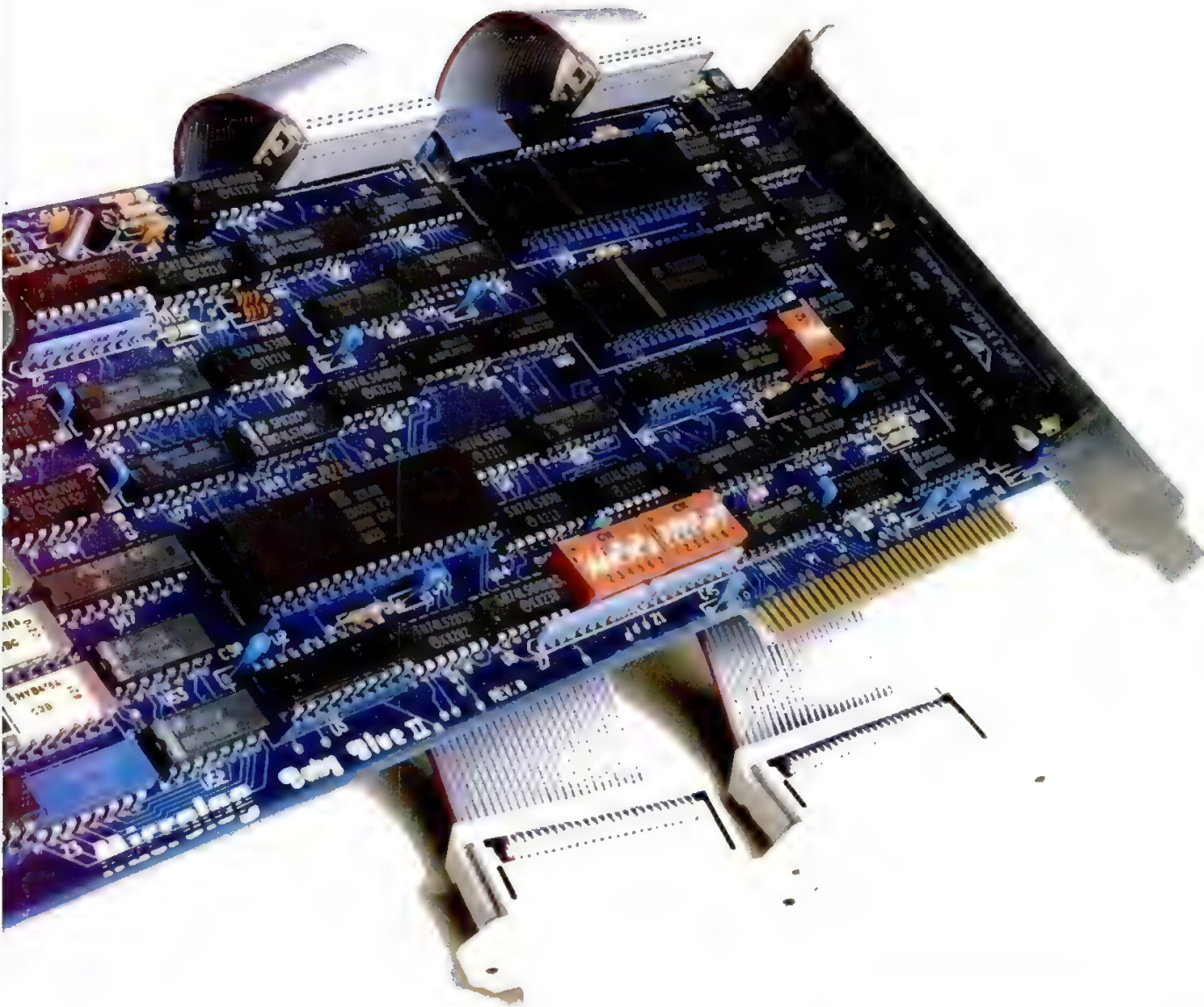
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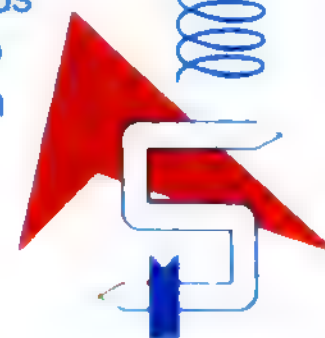
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CIRCLE 833 ON READER SERVICE CARD



Retailing *(continued)*

munity. The company, which packages business systems compiled from several manufacturers, courts corporate customers with high-class service and posh decor. "Their salesmen greet you in the parking lot and they'll go to your office. That's not retailing, that's direct sales," complains a competitor.

Businessland has high overhead, reportedly \$1 million per store, and has yet to make a profit after 2 years. But the company recently sold a \$50 million public stock offering, so its president, David Norman, formerly with the market research firm, Dataquest, can afford to wait for success.

Market share for manufacturer-owned chains slipped from 24.5 percent in the second quarter to 20.1 percent at the end of December. One big reason for the drop was Xerox's decision to sell its stores to the Genra Group, a Dallas venture capital group led by ex-Xerox executives.

Another factor was the slowdown at Tandy Corporation's Radio Shack stores. Tandy continues to add Computer Centers, but at a reduced pace: it opened only 260 in 1983, as compared to 388 in 1981. In the past, Tandy has been hampered by its devotion to its own operating systems, which have limited software. Recently Tandy introduced MS-DOS compatible Tandy TRS-80 Model 2000 which is intended to spruce up sales.

IDC analyst Goldberg says Tandy's hidden strength is its truly national network of stores. "We may be reaching saturation levels of com-

puter stores in the urban areas on the coasts, the high-tech cities, and even the more affluent suburbs. Rural or less urban areas may hold some promise—and Tandy stores are in small towns already," he says.

Finally, of course, there are the 57 manufacturer-owned IBM Product Centers, each with a direct line to the hottest selling family of computers in any town—the PCs. IBM has the resources and the products to support a

huge consumer retail operation—if it wants one.

IBM's consumer operation makes other retailers nervous. As always, rumors abound that Big Blue may change its operating systems—hurting compatible manufacturers—or reduce its distribution to dealers in favor of its own Product Centers.

Since most retailers admit depending on IBM for more than 50 percent of their sales, a more exclusive IBM

marketing policy would hurt many dealers. "A lot of stores are basing their expansion plans on the sales of IBM compatibles, and that scares me," says Coggs of Software Access, who warns investors to think carefully about such factors before investing in computer retail companies.

"Of course it's risky to base all your business on IBM," Harmon says. "In this market, however, it's a lot riskier not to." ■

PC Clone Fight—Maybe

But, there's a question whether IBM will follow Apple in prosecuting the counterfeit PC manufacturers.

BY MARTIN PORTER

IBM has begun to reinforce the U.S. border-police with trademark and copyright information to protect against an anticipated flood of Personal Computer lookalikes and pirates that are currently widely circulated in the Far East.

Counterfeit PCs are currently commonplace in Hong Kong where they are sold for as little as \$600, and in some cases the white/gray boxes even carry an IBM logo. At the time IBM officials denied knowledge of any counterfeits and an internal IBM investigation revealed that the company hadn't taken precautionary measures stateside by equipping customs with trademark and copyright details that would be used to intercept fraudulent products before they entered the country.

Now IBM has sued a Hong Kong micro manufacturer for copyright infringe-

ments and has registered two copyrighted manuals—*IBM Personal Computer BASIC* and *IBM PC DOS 1.0*, as well as its trademark with customs officials. Meanwhile, the company has 20 additional copyright applications pending in the registration files of the Entry Licensing and Restrictive Merchandise Branch of U.S. Customs. All the applications, which will require 3 months of processing, are either software or manual related.

A customs source acknowledged that all the IBM copyrights had been filed since he was first contacted by *PC Magazine* several months ago. He added that they had not been prompted by the surfacing of counterfeit PCs in the United States. "As yet, no counterfeit PC seizures have been made," he said.

The Customs procedure

follows the lead of Apple Computer, Inc., which has used the tactic to intercept Apple II knockoffs that are reaching U.S. borders by the thousands each month. However, at least one domestic research group now predicts that, unlike its micro competitor Apple, IBM may decide against fighting the relentless Far East knockoff machinery—that reproduces everything from micros to designer watches—and actually license its low-cost competition instead.

This was one of several conclusions reached by International Resource Development Inc. (IRD), a market research firm in Norwalk, Connecticut, which issued a report entitled "Far Eastern Vendor Strategies for U.S. Microcomputer Markets," in late 1983.

According to IRD president Kenneth G. Bosom-

(continued)

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Clone (continued)

worth, "IBM is looking at the relative lack of success Apple has had fighting piracy. They might choose against a fruitless 5-year path in the courts or they might attempt to provide some element of control."

That control, Bosomworth speculates, would entail licensing its technology—a move IBM has successfully followed with its mainframe line—and thus receiving a royalty for every Far Eastern PC lookalike sold. The IRD report concludes:

"Such a licensing program would not hurt IBM in the short term, because demand for the PC is continuing to exceed IBM's production; however, the Taiwan-built PC clones could be 'bad news' for such U.S. vendors as Compaq, Columbia, Texas Instruments, Apple, and Radio Shack, all of whom market PC-compatible equipment or are expected to announce it soon. Some of the Taiwan-built PC clones will sell for less than half of IBM's price."

The reputed poor quality of these Oriental-made goods has often been touted as an argument in favor of domestically manufactured products. However, ever since the derisive tag "Made In Japan" has been turned into a compliment, the marketing attack no longer holds with either manufacturers or consumers. Bosomworth's research staff concurs:

"In Asia you can't get away with putting out rubbish the way you would 10 years ago. Quality control seems to be quite good and in some cases the consumers seem to prefer their prod-

ucts."

The IRD report adds that "it is not yet clear whether the PC copies will be viewed as superior to the products of IBM's Boca Raton plant; to most buyers the major attraction of the clones may be the price and availability advantages. In any case, U.S. buyers of microcomputers are likely to be buying rapidly increasing numbers of micros built in the Far East, some of which will have familiar American names on them."

Meanwhile, many of the Far East manufacturers are becoming so reputable that they are now prime candidates to manufacture (or OEM, in the trades) micros for domestic firms. IRD reports "strong rumors" that one Korean company, Gold Star, will manufacture AT&T's first entry into the micro computer marketplace, a 32-bit super-micro expected to be introduced during the first quarter of 1984. This will be the first in an anticipated series of four machines the divested phone company will announce this year which will also include a low-cost home computer.

To date IBM hasn't tapped its Far East assembly and manufacture resources for its Personal Computer, though an inconspicuous "Made in Taiwan" stamp is on the back of any PC monitor. IRD speculates, though, that the forthcoming IBM portable computer may be the first PC product to indeed be entirely manufactured overseas, the result of an agreement between the company and the Japanese electronics giant Matsushita made 2 years ago. ■

IBM Isn't King in UK PC Market

Victor with ACT Sirius gets headstart on IBM PC in Britain, consultant says.

The whole world doesn't worship at the altar of the IBM PC...at least not yet, according to David Ferris of the Ferrin Corporation consulting firm.

Britain is one country where exposure to the PC is lagging by about a year, said Ferris, who just returned from the Computing Workshop, the United Kingdom's equivalent to the National Computer Conference.

"In the U.S., both IBM and Radio Shack have had major penetration, but so far, both have had a much smaller share of the action in the U.K.," he said.

This is not to underestimate IBM's prowess in the British market. A survey by the Ferrin company showed that large British companies are now trying to standardize on the IBM PC, much as American firms have.

While it's not the market leader in Britain, the IBM PC is making a respectable showing as the number two best-selling 16-bit computer there. Number one is the ACT Sirius (Britain's version of the Victor 9000).

"The ACT offers more for the businessman in this country," said British journalist Maggie Burton, who writes about computers. "It was Number One in the market months before the IBM began to appear." ■

PC-compatible equipment is showing up on distributors' shelves, Burton said, but British consumers are wary of systems that claim compatibility and yet only offer similar disk formats or operating systems.

The British wariness extends to most computer purchases. The Ferrin company survey showed most businesses there are waiting for the competing manufacturers to fight it out for market supremacy before they make any major purchases.

Ferris observes that British corporations have used the delay in the introduction of the PC to their advantage—letting American companies do product testing for them.

Unlike in the U.S., where most early computer users were what Ferris terms "enthusiasts," British computer fanatics who are obsessed with the technology are very few by comparison. The majority of potential users there are interested in using them to perform tasks, not in learning how they do the job.

While the U.S. computer market has trickled down from the "enthusiasts" to mainstream users, that kind of penetration hasn't yet happened in England. "PCs haven't exploded yet...so to speak," Ferris said. ■

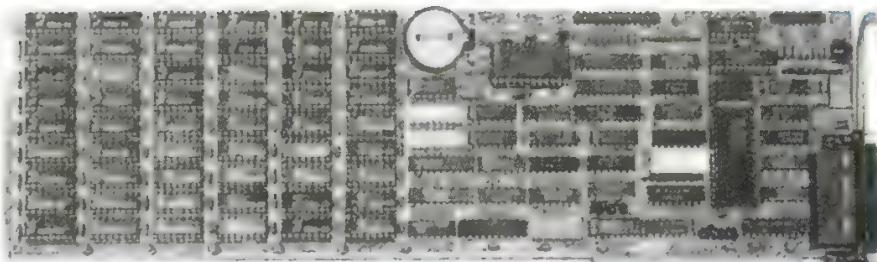
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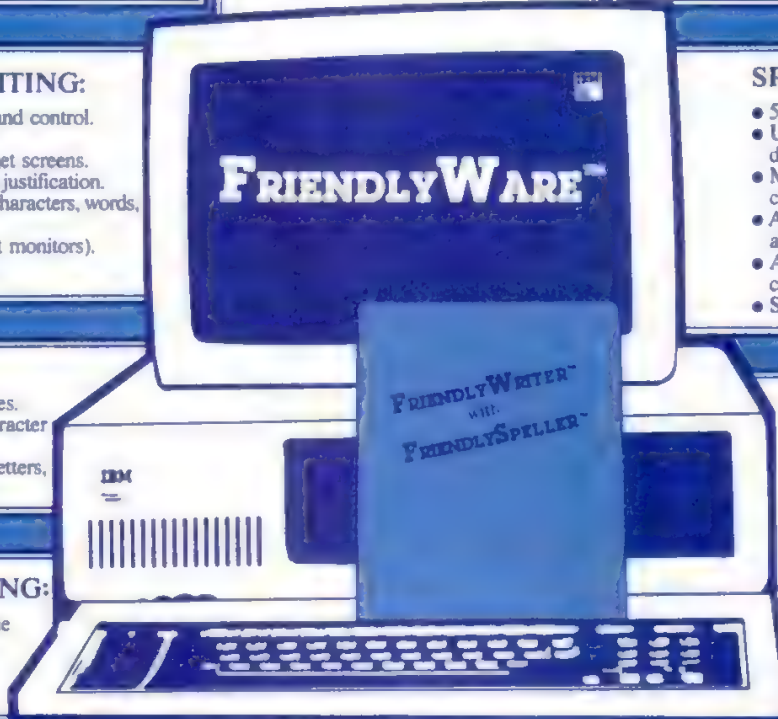
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Apple Wins Copyright Fight

But in narrow decision against Franklin Computers, other key issues are left open

BY ELIZABETH BIBB

The case of Apple vs. Franklin is one of the latest in a long list of suits involving the question of the copyrightability of computer programs. According to most legal observers, Apple's victory in the most recent ruling in that suit lays to rest the question of the copyrightability of computer programs, even though some other murky legal questions in the suit remain to be hashed out in the courts.

The consensus of the courts is that programs, including source codes and object codes, are copyrightable—regardless of whether they are stored on floppy disks or embedded in a microprocessor.

Last August, a federal judge threw out a lower court ruling that allowed Franklin Computers to manufacture an Apple clone, the Franklin ACE 100 computer. Specifically, Judge Dolores Sloviter of the U.S. Third Circuit Court of Appeals in Philadelphia (near Franklin) ruled that computer programs, including operating systems buried in ROM, are copyrightable and that Franklin had infringed on Apple Computer's copyright by copying 14 of their programs. (Sloviter had previously affirmed in *Williams Electronics vs. Artic International* that programs in ROM are copyrightable.)

In the Franklin action the

lower district court, also in Philadelphia, had refused to grant Apple's injunction because it "had some doubt as to the copyrightability of the programs" stored in ROM, because they could only be "read" by machines. Judge Sloviter's vote for Apple by reversing that decision capped the list of many such rulings and confirmed that computer programs are indeed copyrightable works of authorship that may be "fixed" in any tangible medium of expression, as cited in one of the cases. That definition is in keeping with the language of the 1980 amendments to the Copyright Act of 1976. (In the Copyright Act a program is defined as "a set of statements or instructions to be used directly in a computer in order to bring about a certain result.")

Among the list of rulings is another Apple victory against Formula International, Inc. Last April, Formula was stopped from, pending trial, marketing a computer kit, named "Pineapple," which used five programs copied directly from Apple's *Autostart*, *AppleSoft*, *HELLO*, *DOS 3.3*, and *Apple Integer Basic* programs.

What has not yet been addressed in these cases, and still remains an issue in the big Apple vs. Franklin suit, is whether the copied operat-

ing system could be rewritten in any other way and still remain functionally equivalent. If not, a patent, rather than a copyright, would be the way to legally protect the system from unauthorized copying. Patents protect original and unique ideas; copyrights protect the expression of those ideas, either in the form of literary works or instructions.

Because of this debate over the ability to create operative equivalents, industry observers have watched the Apple vs. Franklin case with great interest. In the fast-paced computer market, getting copyright protection is preferable to a patent. Copyright registration takes less time, is easier to obtain, and extends longer coverage than a patent.

Franklin contends that the Apple operating system is not copyrightable because to create a system that ran Apple compatible software, they had to duplicate Apple's version. If a program can only be written in one way, Franklin argues, that program is an original concept, rather than just one form of expressing that concept—and therefore it is not eligible for copyright protection.

Apple denies there is only one way to write their system program and has introduced evidence of successful third party rewrites of some of their programs.

"I could rewrite it (the operating system) myself if I took a year," said Daniel Wendin, in-house counsel for Apple in Cupertino, California.

Reverse engineering—breaking a system down into its component parts, analyzing and then restructuring its design specifications—avoids the copyright controversy, says Wendin. But few manufacturers are willing to spend the time or the money to go through the process, he said. It's easier to copy an existing program.

Franklin admits copying the works involved in the suit, but maintains they are innocent of infringement of this "one-of-a-kind" argument. Judge Sloviter did not rule on whether functional equivalents to Apple's programs could be written. She presumed the programs to be written expressions of an original concept, not the concept itself. In this case, as in many like it, the courts have not dealt with the finer distinctions involved in the technology.

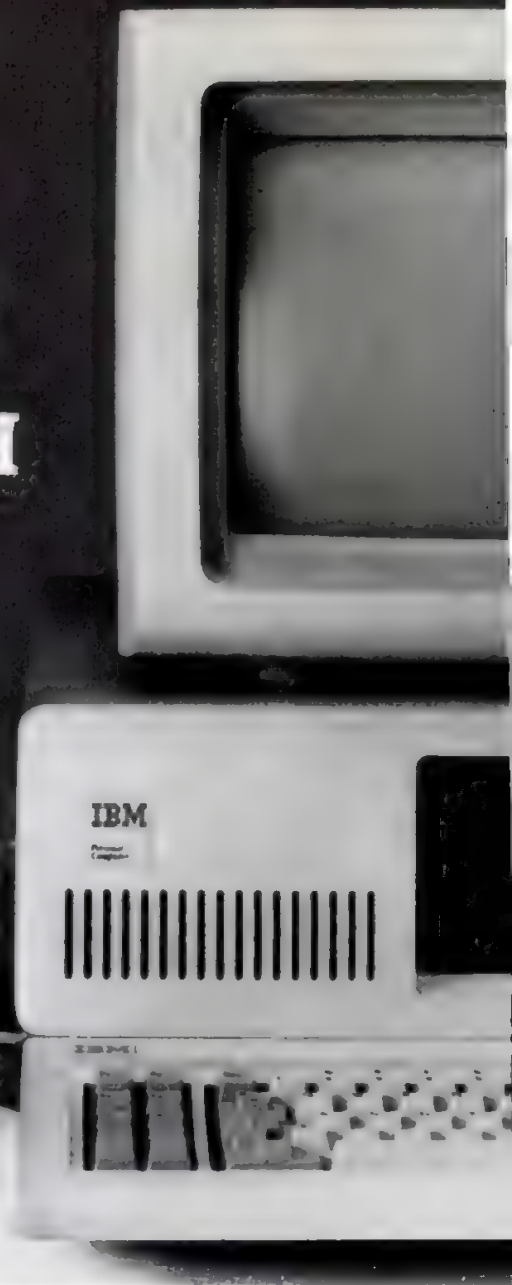
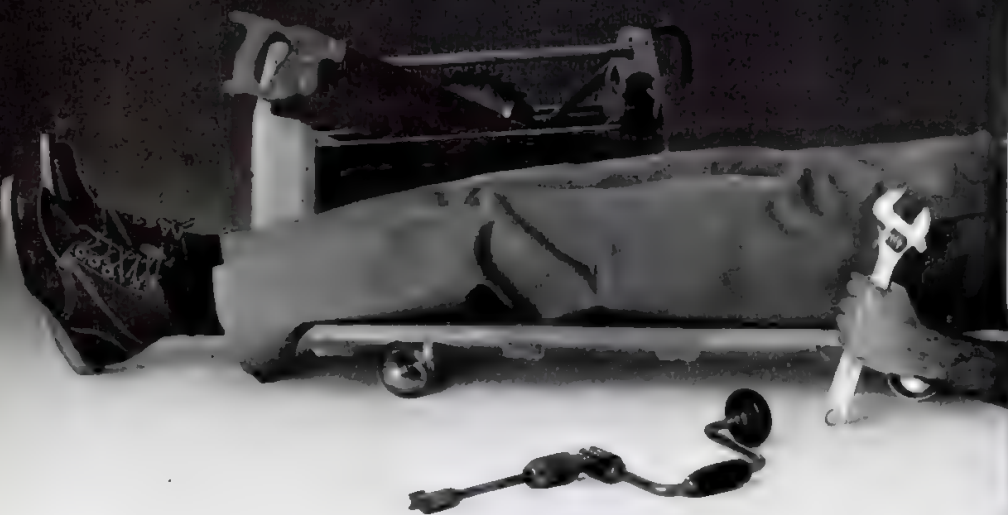
Because no other court has ruled on the idea/expression dichotomy yet, the New Jersey-based Franklin wants the U.S. Supreme Court to hear its case.

Wendin doubts the Supreme Court will accept Franklin's case, but even if it doesn't, he believes the case is far from over.

"An out-of-court settlement is highly unlikely," Wendin said. "Apple has been very aggressive in fighting cases like this, and within the limits of our resources, we will continue to fight it." He predicted the two companies will be back

(continued)

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Apple (continued)

in district court soon over the question of whether the disputed programs can be rewritten. Other legal observers, however, are confident the case will go all the way to the highest court.

"It's the landmark case," said Robert Bigelow, attorney and publisher of the Computer Law and Tax Report in Woburn, Massachusetts.

"It seems likely that there will still be litigation. Only three out of twelve courts have discussed these questions," Bigelow said.

While the Apple vs. Franklin decision will relieve many manufacturers, Franklin is still chomping. Pending further litigation it's manufacturing the ACE-100 Apple copy and is about to introduce an IBM-compatible machine, Franklin president Arvin Miller said.

IBM (at least on the PC), has encouraged the development of compatible systems and third-party applications software by separately licensing the use of its operating systems and software, thus avoiding Apple's legal maneuvers against copy cats, Miller said.

* * *

Other recent cases, Artic vs. Midway and Midway vs. Strohon, also address the copyright questions:

In Artic vs. Midway, the U.S. Supreme Court let stand a circuit court decision that both audiovisual works and the computer chips that generate them are copyrightable. Midway Manufacturing, owners of the *PacMan* copyright, sued Artic International, Inc., for distributing a kit that speeds up the play of the game. Artic ar-

gued that the images of a video game cannot be protected by copyright.

In Midway's suit against Strohon, Judge Hubert Will also held that a *PacMan* modification kit made by Strohon was an infringement of its copyright, but not its audiovisual copyright.

Because the modification included the removal of one Midway chip and replacement of five others, the *PacMan* gobbler wound up looking like a block. The judge ruled that the distinctive visual image of the game was changed sufficiently to avoid any infringement.

Judge Will also relied on the Midway vs. Artic case to counter Strohon's argument that the company had lost its right to control the use of the *PacMan* machines because Midway sold, rather than licensed them.

This case, like Apple vs. Franklin, confirmed that object codes were copyrightable, regardless of where they were stored.

Will, like Judge Sloviter in Apple vs. Franklin, relied on the definition of a computer program as it appears in the 1980 amendments to the Copyright Act of 1976.

All these cases help define the parameters of copyrights, but often even legal protection is no defense against a vast majority of undetected software pirates.

Industry followers estimate that there are at least five to ten pirated copies for every licensed sale of software in the U.S. The producer of *dBasell*, Ashton Tate, estimates that based on the more than 100,000 purchased copies of the database program, there may be nearly two million pirated

versions.

Such illegal copying of software cost the industry an estimated \$1 billion in 1983.

One of the most aggressive opponents of such piracy is MicroPro, which has been battling copyright infringement both in the United States and abroad.

They've successfully tackled two German firms this year and even set up a "sting" operation to prove that a Berlin dealer had stolen its software, which includes *WordStar*.

That word processing software was sold for \$399.20 in United States currency to MicroPro's undercover agents. Its average retail price is \$516. The company was awarded about \$200,000 in damages by the Berlin State Court.

It was also awarded the same amount after several sets of pirated computer manuals were retrieved from a software house in Paderborn, Germany, confirming the company's accusations that the manuals had been lifted.

MicroPro has kept its guard on the domestic front, as well. It filed a \$10-million lawsuit last spring against the United Computer Corporation to prohibit rental of software. United called the suit "unfair harassment," and the company's president George Pollack said MicroPro is trying "to unfairly interrupt a legitimate rental service to potential buyers of software." He claimed that United has never violated any of the copyright agreements with MicroPro. ■

How Much Is That Floppy In The Window?

Until now, few tales of digital heroics have matched the legend of "The Little Engine That Could." Recently, however, we heard the saga of a valiant floppy disk in Minneapolis.

The story began as Tim Braun, sales manager for a midwestern distributor of TDK diskettes, cast about for a way to promote this new line of floppies. Braun hit upon a striking way to test TDK's claim that its disks would withstand up to 10 million passes before wearing out. He would put an IBM PC in the window of Software Centre's store in downtown Minneapolis, boot it up with a TDK disk, and run the disk day in and day out until it dropped. What's more, there'd be a contest. The person who came closest to guessing the

number of times the disk was read before it cracked would win the PC.

Once TDK bought his idea (and the PC), Braun arranged for Chris Buck, a programmer and part-time consultant at the Software Centre, to write an IBM BASIC program that would keep track of the number of times the disk was accessed. With Buck's software, during each complete 10-second cycle the PC read a file to find the number of the latest pass, updated the number, then wrote the new number onto two different sectors of the disk. The program displayed a running record of the number of passes on the PC's monitor.

One of the people who noticed the contest was Phil White, an electrical engineer

(continued)

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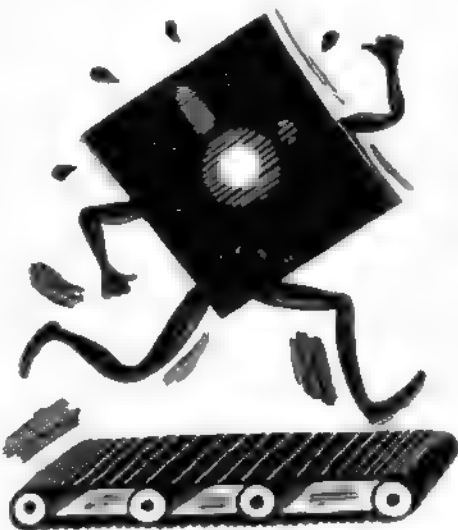
who works for MPI, a company that makes disk drives used by IBM in some of its computers. From his experience with testing floppies in MPI's disk drives, White didn't think the TDK disk would last more than a couple of weeks. He hit upon a plan for winning the contest. He would keep track of the number of passes the PC made in a single day. Then he'd come to the store each day during his lunch hour and submit his guess—the number of passes the machine would have made if the disk failed exactly at midnight.

On April 26, 1983, the Softwaire Centre's staff opened up a box of TDK diskettes, pulled out one at random, and popped it into the PC's A: drive. The computer booted up Chris Buck's program and the diskette began its trial. Phil White and about ten other entrants inaugurated faithful daily vigils at the store.

Spring wore on into summer, and summer moved toward fall, but the diskette showed no sign of giving up. In early August, TDK boasted that the disk had been read 700,000 times. A week into September, the diskette passed the 1 million mark. At the Softwaire Centre, office manager Cindy Damann Harner's office was overwhelmed with nearly 3,000 contest entries. "After a while," she says, "I just wanted the contest over and the stuff out of my office."

Before another week had passed, fate was kind to Cindy Harner, but not to the long-playing diskette. On Tuesday, September 13, 1983, at approximately 9:45

a.m., the 5¼-inch disk made its last pass, then passed away. Tim Braun isn't quite sure why the diskette finally quit. "The read side looked fine," he says. "There was one little spot on one track, perhaps where the disk drive head touched it. We thought at first that it was the drives that had stopped running."



Is TDK embarrassed that its diskette only survived about 11 percent of its projected performance? "Considering the conditions, it's amazing that it even lasted that long," says Arnold Singer, a company spokesman. "That disk was subject to sun, heat, humidity, and dust." The 10-million claim was based on tests conducted in perfectly sanitized laboratories.

Not surprisingly, the proud owner of the PC is now Phil White. His guess came within 2,000 spins of the last pass. The next closest prediction, submitted by another of the daily watchers, was more than 10,000 cycles off. "I guess they didn't work the system out as closely as I did," White says.

And what of the deceased diskette? Once its ordeal was ended, the disk's remains were taken back (perhaps in a casket) to TDK laboratories for further analysis. ■

Apple Gives Lisa Big Business Link

New hardware, software allows Lisa users to emulate Digital, IBM terminals

BY CONNIE WINKLER

CUPERTINO, CA—Apple Computer now has two hardware products to allow Lisa users to connect to Digital Equipment Corp. (DEC) or large IBM systems—via IBM 3270 terminal emulation.

LisaTerminal, data communications software for Apple's professional computer, allows the Lisa to emulate DEC's VT100 and VT52 terminals and traditional TTY terminals to exchange information through modem's to computers supporting asynchronous protocols.

The Apple Cluster Controller is a \$4,500 (three ports) to \$7,000 (seven ports) protocol converter that emulates IBM's 327X controller. In combination with the *LisaTerminal* software (\$295) it connects Lisa to IBM mainframe networks by emulating IBM 3278 Model 2 terminals.

Until this announcement there was no formal way to connect Lisa—which is designed for non-technical professionals in large corporations—to the large computers and data bases within their corporations.

(Late in 1983 Apple pulled out of a scheme with Cullinet Software, Inc., of Westwood, Massachusetts, a big, mainframe data base man-

agement system supplier, to connect Lisa's to mainframes.)

"With *LisaTerminal* and the Apple Cluster Controller, users not only have access to the vast amount of information stored on remote computers, they also have the advantage of working with the Lisa's...applications—such as word processing, project management, financial modeling, and business graphics," said E. Floyd Kvamme, executive vice president of Apple.

Like the other six software packages encapsulated in Lisa, *LisaTerminal* gives visual, icon interfaces, multiple windows, and cut/paste integration between applications. In the last instance, information could be transferred from the remote computer to Lisa's word processing application, *LisaWrite*.

The Apple Cluster Controller converts to asynchronous protocols either Binary Synchronous Communications (BSC) protocols or IBM's big-system architecture, System Network Architecture/Synchronous Data Link (SNA/SDLC). It has three to seven serial RS232 ports so that up to seven Lisas or serial printers could be attached to the IBM 3270 network through one controller. ■

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Hello, Big Sister

Voice synthesis technology comes to Dun & Bradstreet's credit reporting

BY LESLIE BAKER AND NAT SAKOWSKI

NEW YORK—Dun & Bradstreet, the company that keeps tabs on credit ratings now wants to reach out and talk to someone. It's announced DunsVoice, with what D & B proudly proclaims is the latest in voice synthesizer technology. It is computer-generated voice simulation and it sounds surprisingly, and eerily, human.

The new setup works like the simultaneous translations used at the United Nations. In this case, users speak to the computer in its language—punching buttons on a telephone keypad—and the computer responds in English. All very civilized.

DunsVoice provides access to the credit ratings of 5 million businesses in the Dun & Bradstreet database and the company claims it is the first major commercial application of computer voice technology.

"DunsVoice is the latest step in a Dun & Bradstreet tradition of exploiting advanced technology to expand the availability and value of business information," said Charles W. Moritz, president and chief operating officer of the New York-based firm.

The DunsVoice announcement comes just a few weeks after D & B offered a customized personal computer for financial analysts: the IBM PC/XT, only

available from Dun & Bradstreet, but serviced by IBM Corp.

The company would not comment on whether a DunsVoice-like application might ultimately run on the PC/XT.

While the voice synthesizer spoke in clear, pleasant, humanlike tones, D & B officials were silent about who provides the voice synthesis system, how it accesses the computerized database and with what equipment, where the local modules were placed, or any other technical information.

Stubbornly protecting the mystery and the magic, George J. Feeney, vice president, advanced development, would say only that small modules that access the mainframe and synthesize the voice were distributed nationwide in 79 locations, providing users with local phone access to credit information. Period.

D & B ran an 8-city, 6-month test of DunsVoice, with results good enough to encourage them to roll the product out nationally. Since its introduction late last year, 1,300 businesses have subscribed to the service. D & B spokesmen declined to specify how many of that number were already customers. The present marketing effort is limited to one-on-one sales calls.

While D & B may have

figured out how to put it all together, it is obvious from their elaborate veil of secrecy that they have made good use of existing, third-party-developed technology.

"Customer reaction to DunsVoice has been extremely favorable in our test markets," said James E. Rutter, president of Dun & Bradstreet credit services. "Customers like the convenience and immediacy of just picking up the telephone. They like the friendly conversational style of DunsVoice. They like having direct access to the most current information in our National Business Information Center database. And they particularly like being able to mix and match the specific information they need in each inquiry."

DunsVoice customers can

select a credit rating; a summary of payment experience; the median payment schedule of the company's industry and a business summary which includes sales, net worth, number of employees, condition and trend of the business, the name of the principal officer, and the year the business began.

One user, Priscilla Gayle of Continental Jet East admitted "it was freaky at first." But the other test participants did not even acknowledge the strangeness of talking to a machine with the voice of a woman. Far from it. In fact, one test user, Mary Anne Johnson, credit manager of Dolls by Jeri said, "I can get any information I need in 5 minutes. She's always there."

Big Brother, it seems, has become Big Sister. ■

Firm Puts Pictures in PROFS for PC

Icons for PC give "friendly interface" to IBM's Big 370 Professional Office System

BY CONNIE WINKLER

While IBM's XT/370 puts the power of the System/370 on a desktop, that electronic desktop can remain pretty cluttered with cumbersome menus and commands, if the 370 is running IBM's giant electronic office package, PROFS.

Now an Atlanta software company says it's clearing off that desktop with PC-PROFS, what it describes as a "friendly interface to IBM's Professional office system" that runs on the IBM PC and XT.

It's the icon system interfaces—pictures of notepads, wastebaskets and file cabinets—which Applied Microsystems, Inc. in Roswell, Ga. says will attract PC users to PC-PROFS. Even those who are running PROFS on the XT/370 personal computer which IBM announced last year, says Russell F. Still, one of the founding vice presidents of the Roswell, Ga. firm.

Instead of plodding through five PROFS menus (continued)

Hello (continued)

to get to the application they want. PC-PROFS users simply select the icon for the process they want (not unlike the Lisa from Apple Computer Corp. or the Star 8010 from Xerox Corp.)

Users can cursor select common office artifacts such as a file cabinet, in/out trays, note pad, and wastebasket. An integrated text editor allows local document development and appointment scheduling is also performed locally.

Ease of use is accomplished by the icon manipulation, instantaneous screen swapping and full support of "F" and cursor control keys.

PC or XT users with color graphics can create documents locally and then over asynchronous lines dial up the PROFS running on the big 370. Users must also have 256K main memory, one double-sided diskette or hard disk, a Hayes (or compatible) Smartmodem (300 or 1200 baud), and a printer.

Many users in large corporations require PROFS (Professional Office System) because of their company's dependence on, and commitment to large 370 mainframes. PROFS allows users to write memoes and then distribute them electronically through the corporation.

PC-PROFS is an interface between PC-DOS and PROFS running on a System/370 VM/CMS system.

PC-PROFS is currently being tested by The South-

ern Company, which operates Georgia Power Company, where it will be installed next, Still said.

Prices are yet to be set, but Still estimates a corporate license will be about \$5,000. PC-PROFS was developed by three principals who, as former consultants, spent a lot of time developing VM systems, Still said.

A demonstration diskette of PC-PROFS is available for \$10 from Applied Micro-Systems, Inc., P.O. Box 832, Roswell, GA 30077. ■

Calendar of Events

DATE	EVENT	COMMENT	LOCATION	CONTACT
March 7-9	Data Communications In-Depth Workshop	Presentations on the managerial, technical, and operational aspects of data communications.	Hyatt Regency 102 Carnegie Center Princeton, NJ 08540	Data-Tech Institute 386 Franklin Ave. P.O. Box 569 Nutley, NJ 07110 (201) 661-2300
March 14-16	See above	See above	Scottsdale Hilton Scottsdale Rd. at Lincoln Dr. Scottsdale, AZ 85253	See above
March 12-15	Interface '84	A 54-session conference highlighting the impact of desktop computers and the AT&T divestiture on large organizations.	Las Vegas Convention Center Las Vegas, NV	The Interface Group 300 First Ave. Needham, MA 02194 (800) 325-3330 (617) 449-6600
March 23-25	West Coast Computer Faire	Hardware, software, and speeches by prominent industry executives.	Civic Auditorium and Brooks Hall San Francisco, CA	Computer Faire, Inc. 181 Wells Ave. Newton, MA 02159 (617) 965-8350 (415) 364-4294
April 5-7	COMDEX/Winter	Hardware and software for computer dealers.	Los Angeles Convention Center Los Angeles, CA	The Interface Group 300 First Ave. Needham, MA 02194 (800) 325-3330 (617) 449-6600
April 9-11	National Online Meeting	Presented papers, product review sessions.	Sheraton Centre Hotel New York, NY	Learned Information, Inc. 143 Old Marlton Pike Medford, NJ 08055 (609) 654-6266
April 13-15	Interstellar Personal Computer Show	Hardware and software.	Spokane Interstate Fairgrounds Spokane, WA	Hey-Mac Promotions 3607 E. 33rd Spokane, WA 99203 (509) 534-3661

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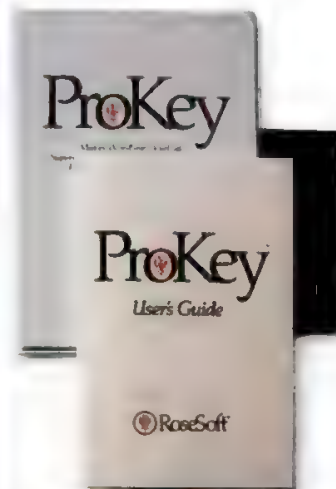
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To run ProKey, you'll need an IBM Personal Computer or workalike DOS (any version, including 2.0), and 64K of RAM (WordStar requires 96K).

WordStar, VisiCalc and dBase II are trademarks, respectively, of WordStar Systems, VisiCalc Systems and dBase Systems, respectively.

People in the News: Kazuhiko Nishi

Japan's software wonder has opened many doors for Microsoft, but has he also closed some?

BY KATHLEEN BURTON

Bellevue, Washington—The gods must have been smiling back in 1977 when Kazuhiko (Kay) Nishi picked up the phone in Tokyo and placed a long distance call to Bill Gates "somewhere" in New Mexico. He was only 2,500 miles off from where Gates, the chief executive of Microsoft in Bellevue, Washington, really was. But the determined Nishi knew what he wanted.

"I had decided that if the Japanese couldn't come up with good software, then I would try," said the 21-year-old dropout from Tokyo's prestigious Waseda University. Access to Bill Gates and his BASIC programming language was a key component in Nishi's plan.

After finally reaching Gates on the phone, Nishi offered him a plane ticket to Japan, which Gates declined. The two ultimately met at a microcomputer show 2 months later and "talked for 9 hours straight," according to Gates, who found they had much in common.

Both were 21 years old, ex-Eagle Scouts, and recent college dropouts (Gates, a math major, had left Harvard). Both had financial backing from their families and, most importantly, both were convinced of the software Zeitgeist that lay in the untapped, still-dormant software market.

The two signed a one-page document and agreed to do business. Since then, "we've done over \$30 million worth of business based on that one-page contract."



Kazuhiko Nishi

said Gates.

As an abstract thinker and level-headed businessman, Nishi, is a good foil for Gates' more theoretical and technical approach. Together they have piloted Microsoft from an obscure, out-of-the-mainstream software firm into one of the major software players. Its revenues hit the \$100 million mark in fiscal 1983, and, according to one estimate, it supplied 40 percent of all personal computer software in 1983.

The trust between Nishi and Gates deepened in July

1980 when IBM approached Microsoft in its search for an operating system for its yet-to-be released personal computer. Gates reportedly thought about sending IBM

to rival Digital Research, Inc., and its CP/M and CP/M-86 operating systems. But, trusting Nishi's business acumen, Gates custom tailored 86-DOS, a 16-bit operating system that Microsoft had licensed from Seattle Computer Products, a small hardware firm in the Northwest. The wide acceptance of this operating system, MS-DOS, has placed Microsoft in control of a critical niche, and more importantly, enabled the company to set industry standards in languages and operating systems.

Few people in the microcomputer industry are neutral about Kay Nishi. He is described by those who know him as "driven," "a man of many faces," "volatile," and "scary." Gates calls him "Japan's only true entrepreneur." A college acquaintance says, "Kay always wanted to be the Japanese version of Howard Hughes. For a while he read everything about Hughes he could get his hands on."

Nishi is elusive. He flits from Tokyo to both U.S. coasts and exists in a perpetual jet lag, overseeing his several business interests as vice president for new technologies at Microsoft, and president and CEO of his own company, ASCII Corporation which publishes Japan's most popular microcomputing magazine, ASCII.

His jam-packed 20-hour workdays are legendary. One of Gates' assistants recently found Nishi "asleep on the floor near a Coke machine" following a long weekend of back-to-back meetings at Microsoft. "I just let him sleep," she said sympathetically. "Kay's been known to arrive in Bellevue from Tokyo in the morning and return to Japan the same day. It's not unusual."

Even Nishi's detractors acknowledge that he is doing more to help Japanese PC manufacturers penetrate the

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U.S. market than any other person or company. Nishi has solidified crucial links between Japanese computer manufacturers and the U.S. PC marketplace by routinely redirecting Japanese micro makers to Microsoft and MS-DOS as their first stop in the U.S. Largely as a result of Nishi's efforts, 31 Japanese companies use MS-DOS on their machines.

Nishi's decidedly western approach to business and his brash immodest style have cost him allies in Japan. More serious, however, are allegations from several key industry executives that Nishi has been indiscreet about parlaying his overlapping business concerns to his own advantage, revealing U.S. proprietary design specifications to Japanese manufacturers. (Given Microsoft's position as software developer, it is commonly given hardware still on the drawing boards.)

Some industry watchers maintain that this security question is one reason IBM has not announced support of Microsoft's Windows software and why it is reportedly developing a proprietary operating system (in applications software) for the PC and other products—possibly positioning itself as a competitor with its former partner.

Many consider Nishi's publishing ventures—which publish the details of companies he does business with—a conflict of interest. "People are afraid to cross Kay because they're afraid of jeopardizing their Microsoft umbrella," maintains Jean Yates, president of Yates Venturers, a Los Altos, California market research firm.

"People are jealous," Nishi merely says of his critics. Microsoft sources agree, underscoring Nishi's long term relationship with Gates and the Microsoft first commandment: Never discuss current projects in progress.

Nishi and Gates are currently setting up the MSX hardware standard in Japan, attempting to open Japan's high volume, low-end hardware market to software developers worldwide. Member manufacturers will produce home computers that share basic hardware features, allowing software compatibility and portability. Largely because of Nishi's efforts, the MSX standard has been accepted by 14 of Japan's leading electronics companies and two U.S. manufacturers, Coleco and Spectra-Video.

Industry experts are divided over MSX's impact on the U.S. market. While some predict that it will become the U.S. home standard, others feel it has missed the market entirely.

Jean Yates predicts a "strong anti-MSX backlash at the consumer level in 1984," with Gates targeted as "the man who first opened the door to the Japanese in the U.S."

Although three Japanese firms have already produced MSX machines and several have commercial products in the works, the Japanese Ministry of International Trade and Industry (MITI) is reportedly influencing the 14 signatory companies to withdraw from the agreement, or to produce no significant commercial applications.

A recent Nishi/Gates success story was a collaborative effort resulting in the introduction of the Radio Shack TRS-80 Model 100 lap-sized computer in mid-1983. (A similar version from NEC had been released in Japan earlier in the year.) The Model 100 is a best-seller—75,000 machines in 1983, according to one market research group.

In November, 1983, the elusive Nishi popped up at

the lavish COMDEX party hosted by Microsoft at that surreal pantheon of the garish: Caesar's Palace in Las Vegas. Nibbling cheese and sipping champagne, the cherub-faced Nishi looked at home rubbing shoulders with industry luminaries.

"IBM's mad at me," he said. "They want our relationship to be like this." He placed his palms together. "Whereas I want that relationship to be like this." He touched the tips of his index fingers together, lightly smiled, and shrugged his shoulders.

Nishi's eyes widened. "It's not the money, you know," he said leaning closer. "I love computers and I've got so many ideas about what they can do."

According to Microsoft insiders, Nishi intends to sequester himself in Tokyo for the next several months working on key projects: a second generation TRS-80 Model 100 portable, the next phase of MSX, an intelligent copier, and a personal computer attachment to generate "human sounding music." Also reportedly in the works are graphics displays that "introduce the illusion of motion into computer games," and a "perfect mate" software package that can develop an ideal mate composite from a melange of 50,000 pictures subliminally flashed on a monitor.

Nishi's pairing with Gates and the Microsoft team will be critical in the volatile year ahead as Microsoft gears to fend off rivals in the windowing software competition. Both Nishi and Gates must be hoping that the gods of computer software are still smiling. ■

Be Glad It Didn't Happen To Alexander

Last fall, RB Robot Corporation prepared a landmark event: a so-called "transcontinental" phone conversation between two robots. One RB5X robot in Denver's Museum of Natural History was to call another at the Center for Science and Industry in Columbus, Ohio, and ask it to perform a simple chore.

RB Corp. hoped the test would show that fully programmable robots may someday be versatile personal servants, able to relay information or call for help using communications technology.

On September 28, the RB5X in Denver used its modem to hook into the phone line to Columbus. When RB5X in Columbus picked up the phone, however, it did not hear its instructions. It seems there was too much static on the phone line that had been specially rigged to avoid the switchboard at the museum.

There was nothing to do but say Goodbye, Columbus. RB's engineers went home to Golden, Colorado to work—on refining the hardware, not begging for better phone lines. ■

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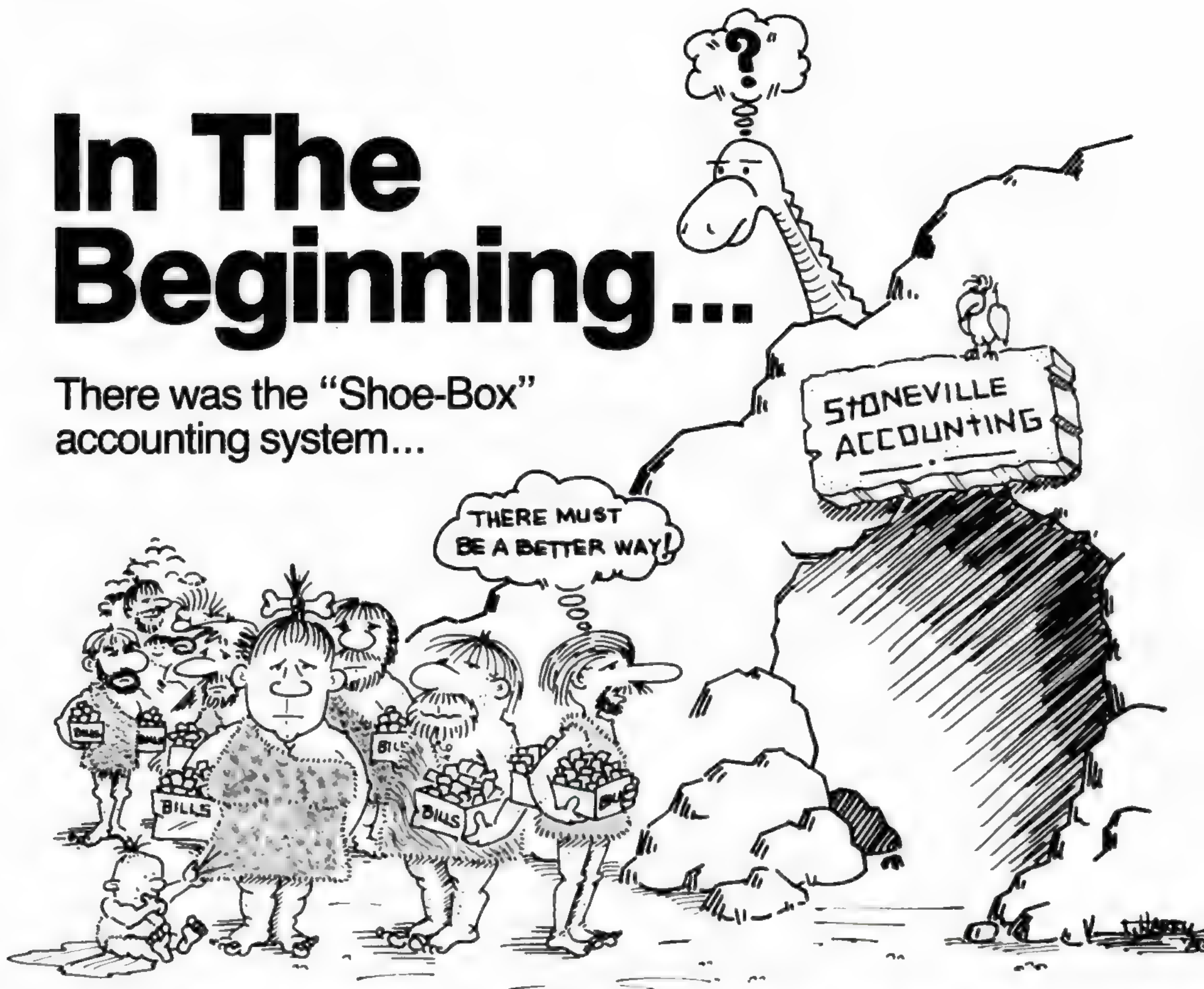
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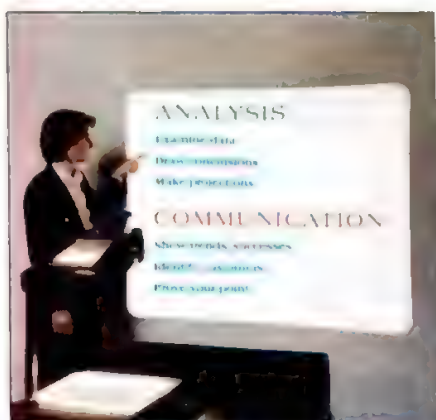
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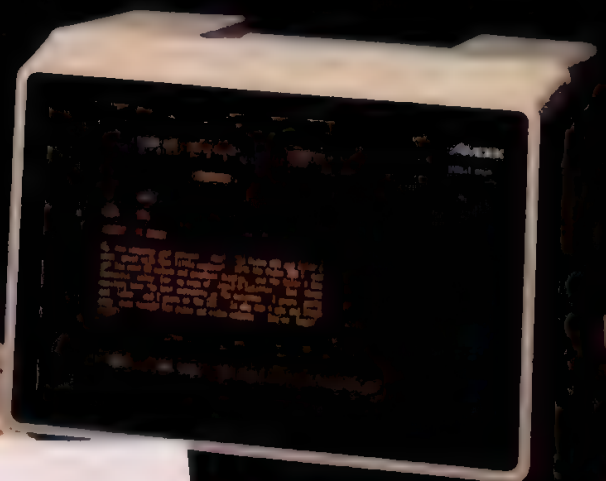
The VIDEO-300 with amber or green screen provides 80 column text or graphics display capability... and its nylon mesh, non-glare screen eliminates distracting reflections.

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CIRCLE 135 ON READER SERVICE CARD



Welcome To IBMdex

COMDEX and Las Vegas are a perfect match; both are overblown, excessive, and nearly obscene. This year, 83,000 turned out to find that everything's IBM.

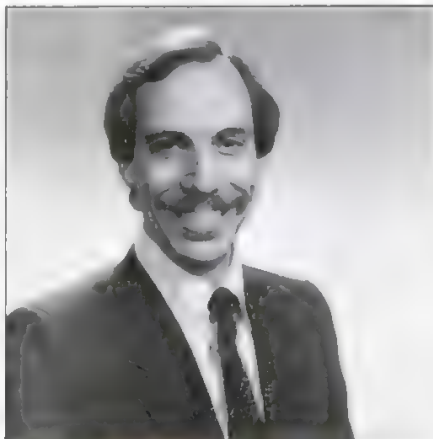
If the Russians ever decide to give this country the big national chest X-ray, virtually every American city will be barbecued to a cinder. Las Vegas, however, will probably emerge unscathed; there's nothing there worth nuking.

Well, that's not entirely accurate. An hour or two after the sun slices into the desert, vast giddy sheets of swirling, liquid neon compete for your rods and cones, strobing side by side in dizzy pyrotechnic excess. This is genuine American folk art, turning a dusty, isolated, little outback whistle-stop into a sort of adult Disneyland. The gambling and the smoky carnality of the place don't hurt it either.

Still, if the Soviets did decide to stir-fry Vegas the last week of November, they'd cut off the flower of microcomputing. Everyone in the business is there, or has a real good reason why not. So why has COMDEX, the show of shows, the nexus of the computer culture, chosen to remain in this little bit of midwest heaven? Simple. COMDEX is an orgy. And what better place for one than Sin City, USA?

No Room at the Inn

Vegas strains a bit more at the seams with each successive COMDEX incarnation. This past year a frightening 83,000 voyeurs went elbow-to-elbow in the world's biggest computer candy store, temporarily increasing the urban popula-



Paul Somerson

tion by one half. In this distant outpost of laid-back Marlboro country, it was a treat to see rival gangs of corporate computer bigwigs going at it tooth and nail for one of the city's paltry 500 taxis. Or to watch wealthy lips that had switched directly from mother's milk to Dom Perignon suddenly confronted with ballpark-quality swill served up at concession stands trailing block-long queues. Or to share the moment as a mighty corporation president discovers that the only available seat to New York is on a flight that stops at 16 Piper Cub landing strips en route.

A large chunk of this charivari was the contingent from the fourth estate, desperately eyeing each new geegaw to ascertain whether this was *the one*—the headliner

that would kick the industry for an Immelmann. COMDEX is chockablock with reporters, PR hypes, industrial spies, and other predators, and when this mob begins to buzz about a hot new item, the feeding frenzy starts in earnest. While hordes of flacks and hacks at the 1983 fanfaronade were trying to decide whether such potential show-stoppers as Panasonic's Senior Partner, Radio Shack's Tandy 2000, or Jack2 were worthy of inky apotheosis, you couldn't get near the respective booths.

Unfortunately, there really wasn't much for the sharks. Yes, this year everything seems faster, smaller, cheaper, sleeker, more powerful. But the real news was that there wasn't much news. Except, perhaps, that they should change the name next year from COMDEX to IBMdex. PCs and XTs and their ubiquitous offspring anchored virtually every exhibit. If you were wearing a green "press" ribbon as you slogged down the aisles, odds were you couldn't go 30 feet before a tag team of rabid public relations thugs pounced on you to wax rhapsodic about how its client's pathetic 8088-based toaster oven was leagues better than the genuine article from IBM. Or, as one canny observer put it: "All these guys should be standing on each other's shoulders. Instead, they're all standing on each other's feet."

There were other attractions besides the



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EDITOR'S SCREEN

cookie-cutter clones, of course. One was a profusion of so-called "environments." The trendiest were those that divide up your monitor to resemble a conventional office work area. Its madcap inventors think this will turn every computer user into a paradigm of organization. What this really means, however, is that now your computer screen can be as sloppy as your desk. Another eye-opener was the profusion of dense storage media. Fujitsu, for instance, was flogging a hard disk that could slip into your XT and hold 86 megs of data. Nice, but after you put the entire *Encyclopedia Britannica* on it, and all your floppies, what do you fill up the rest with?

Barkers, Stars, and Freaks

COMDEX is a field day for marketing mavens and industry watchers. First there's the sizzle, the glitzy big money snake oil shows, the unctuous carny barkers, the freaks dressed as General Patton or a giant box of disks. There's the star fever when one or another boy millionaire makes his appearance and is instantly swarmed by computer groupies. There are the hoarse rumors (the two whispered to me most often were the old standbys that IBM is going to dump Microsoft and that AT&T is just a signature away from snapping up DEC). There are the PR nightmares, such as the three computer systems, from three different manufacturers, all called The Commuter Computer and all selling for the same price. And the acres of models who run your flimsy little badges through the charge account machines. And the jokeware—computers in shades of pink or robin's egg blue, services that promise (or threaten?): "You will never buy software again," a disk drive that runs 18-inch floppies, and much more.

What is most astonishing though, is the show's swollen scale. There were 11 miles of aisles, and 5,700 booths, ranging from glorified shower stalls to multitiered fortresslike installations sprawling over hundreds of carpeted square feet complete with plush, wainscotted offices. Some of

these dreadnoughts reputedly cost their sponsors hundreds of thousands to hammer together. One even sported a bump-and-grind artist on its roof, thrashing through an exercise routine that would make Jane Fonda blush.

To make matters worse, the 1983 COMDEX came in five not-so-easy

If you're lucky you
get wine and dine
and whatever in
some lux Vegas
boite or hospitality
suite.

pieces. If you didn't want to miss anything, you had to traipse through two convention centers and the ballrooms of three far-flung hotels. Next year promises new heights of aggravation, as the show's sponsor, not one to pass up a dollar, extends the floor space to two *additional* hotels. You get the feeling that if the bucks were there, COMDEX would put a dome over the entire city and roll blue shag carpets down the macadam. They're now promoting yet another week of lunacy—this time a winter edition in sunny L.A.—and the troops are almost in open revolt. To lift a phrase from the Paul Ehrlich crowd, stop at two, guys.

Trick or Treat

Still, all the grousing to the contrary, COMDEX is a ball, especially for journalists. You walk around with the standard-issue plastic shopping bags given out free at many of the choicer exhibits, and essentially go door to door, stopping every few feet to open the handles and blurt out, "PC Magazine—trick or treat." After the omnipresent brown-shirted guards kick the last wandering souls out at 5:30, the scene shifts to identical canapé-groaning boards and assembly-line bars in all the hotels; only the vendor names on the front door change. If you're lucky you get

wined and dined and whatever in some lux Vegas boite or hospitality suite.

Years ago, before the federal government decided to make criminals out of ordinary citizens and foster disregard for the law by setting the speed limit at 55, Nevada was the only state with no official top end on the highways. When you cruised in from, say, Utah, you'd be greeted by a sign that hollered: "Welcome to Nevada. Speed Limit—Reasonable and Proper." Nothing else about the state is. Signs by the roadside, for instance: "Double Your Paycheck." Sure. Or how about one of the city's big tourist meccas—the Liberace Museum. I get goosebumps just thinking about it.

Vegas is as much of a 24-hour city as New York or L.A. No clocks or windows in the casinos to distract the players. Restaurants that never close and give away meals at such low prices you'd think they were in pounds, not dollars. Plus bizarre entertainment—the lounge band where we stayed starred four Filipinos in white suits belting out a broken English version of the theme from TV's "Love Boat." A class act.

There are other distractions. I have to admit, it took a while when I returned home to get used to a building lobby that wasn't filled with corn-fed Okies in leisure suits popping quarters into one-armed bandits. And if you don't get your jollies out of trading a dollar bill for 93 cents, you could stomp on your accelerator in other bizarre ways, the most foolhardy of which was probably by visiting FlyAway, where you ante up ten smackers to wait for 2 hours to dress in a baggy flight suit (a la Woody Allen in *Sleeper*) and football helmet, then leap into a padded room over a screaming 16-foot airplane propeller pointing straight up and open full throttle, where you're blasted up to the ceiling if you're good at it and prevented from becoming a radish in a monstrous blender by two thin layers of chicken wire between you and the blades. Well, as they say, life is a gamble. Still, would I miss next year's extravaganza? Are you kidding? ■

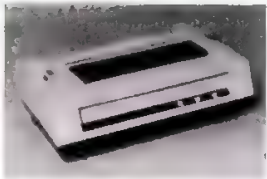
Plain Talk About Printers...

DOT MATRIX

There've been some big changes in IBM-PC printer compatibility. Okidata's new Plug-n-Play ROMs (see below) make a Microline 92, 93 or 84 fully compatible with the IBM-PC, screen dump graphics & all. If you're interested in full compatibility, that's the package to get. We expect that other printer manufacturers will offer similar upgrades shortly.

C. ITOH

Prowriter



C. Itoh's Prowriter (120 cps) features 10, 12, & 16 cpi, a proportional/correspondence quality font, double strike, double-width, sub/super scripts, dot graphics (160 x 144 dpi). The Prowriter 2 is the 136 column version.

Prowriter	\$399.88
Prowriter 2	\$719.88

EPSON

RX/FX Series

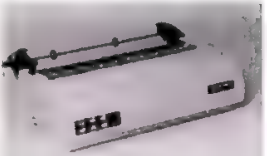
The FX-80 (160 cps) has a correspondence font, 10, 12 & 17 cpi, italics, double-strike/width/ emphasis & dot graphics, plus a 2K buffer. Friction & pin feed is standard; the adjustable tractor is optional & cost extra. The FX-100 is the 136 column version & includes the adjustable tractor.

The RX-80 & RX-80 F/T (100 cps) are upgraded versions of the MX Series.

Epson FX/RX	\$CALL
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MANNESMANN TALLY

MT-160 L/180 L Spirit



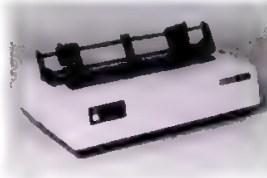
The MT-160 L (160 cps) features 10, 12, 17 & 20 cpi, a correspondence font, italics, enhanced/ boldface print, double-width, sub/ super scripts & underline, friction/ tractor feed. Parallel & RS-232C interfaces standard. The MT-180 L is the 136 column version.

The Spirit (80 cps), Tally's new, low cost draft printer, has 10, 12 & 17 cpi fonts, italics, friction/tractor feed, and a unique square-wire printhead. 80 columns & parallel only.

MT-160 L	\$649.88
MT-180 L	\$849.88
MT-Spirit	\$329.88

OKIDATA

Microline Series



The Microline 92 (160 cps) is ideal for word processing. It features 10, 12 & 17 cpi, a correspondence font, double-width, emphasis/boldface, sub/super scripts, underlining, pin/ friction feed (tractor is optional on the 92) & dot-addressable graphics (120 x 144 dpi). The 93 is the 136 column version. Parallel interfaces are standard; the RS-232C interface is optional.

The Microline 84 (132 col) is the Step 2 version, featuring 200 cps at 10, 12, & 17 cpi (w/double-width), all with a correspondence mode & dot addressable graphics. Parallel or RS-232C interfaces available.

A new PROM called PC Plug-n-Play turns a 92, 93 or an 84 into an IBM-PC compatible printer, with full capabilities. You will sacrifice a few features (like 12 cpi) but the PROMs are worth it if total compatibility is your goal.

The Microline 82A (120 cps) is a data cruncher. Features 10 & 16 cpi (5/8 double-width). Dot-addressable graphics are optional. The 83A is the 136 column version.

Microline Series	\$CALL
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PANASONIC

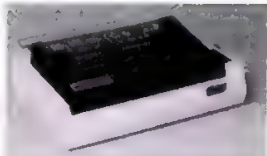
KX-P1090

A smart entry by Panasonic, the KX-P1090 (80 cps) features 10, 12 & 16 cpi, italics, double-width, half-width, enhanced/bold print, dot graphics (120 x 144 dpi), friction/tractor feed & a 4,000,000 character ribbon. The Epson-compatible escape code sequences make it easy to install. Quiet printing & a sharp design make it ideal for home or office. Nationally serviced by Panasonic.

KX-P1090	\$339.88
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STAR MICRONICS

Gemini 10X/15X Delta 10/15



The Gemini 10X (120 cps) features 10, 12 & 17 cpi, italics, a correspondence font, double-width, emphasis/ boldface print, sub/super scripts, underlining, graphics (120 x 144 dpi), a 1K buffer & friction/tractor feed. The Gemini 15X is the 132 column version.

The Delta 10 (160 cps) features both parallel & RS-232C interfaces, & an 8K buffer, plus all the 10X features mentioned above. The Delta 15 is a 136 column version.

Gemini 10X	\$309.88
Gemini 15	\$459.88
Delta 10	\$529.88
Delta 15	\$CALL

TOSHIBA

P1350

An exceptional printer that produces the best near-letter quality we've ever seen. The P1350 prints at 192 cps (100 cps in near-letter quality), & features 132 columns, 10 & 12 cpi (plus double-width) & a near-letter quality font with proportional spacing. It has all the sub/superscripting features you'd expect, plus dot graphics (180 x 180 dpi). Parallel or RS-232C interface (specify).

P1350	\$1759.88
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Other Dot Matrix Printers We Carry

ANADIX

DP-9501	\$1189.88
DP-9620	\$1259.88
DP-9625	\$1369.88
WP-6000	\$2279.88

DIABLO

Series 32	\$1049.88
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IDS

Prism 80	\$1079.88
w/4-color	\$1439.88
Prism 132	\$1239.88
w/4-color	\$1669.88
MicroPrism	\$529.88

INFORUNNER

Riteman	\$349.88
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LETTER QUALITY

The new, low-speed letter-quality printers are making quality affordable. And the high-speed models are coming down in price too. Still, get a dot matrix printer for drafts & as a backup.

C. ITOH

A10 Starwriter F10 Starwriter Printmaster



The C. Itoh Starwriter (40 cps) features 10 or 12 cpi, sub/super scripts, underlining, 6/8 lpi, 1/48" line feed, 1/120" horizontal resolution. It uses Qume code & Diablo wheels & ribbons. The A-10 Starwriter has the same specs, but it prints slower (20 cps). The Printmaster has the same specs, but it prints faster (55 cps). Both the Tractor Feed and the Sheet Feeder fit all three models.

A-10 Starwriter	\$609.88
F-10 Starwriter	\$1219.88
Printmaster	\$1569.88
Tractor Feed	\$289.88
Single Bin Sheet Feeder (A10/F10)	\$619.88

SILVER REED

EXP-550/500



The Silver Reed EXP-550 (17 cps) is a 132 column letter-quality printer with 10, 12 or 15 pitch, sub/super script, underlining and true Diablo 1810 emulation, making it compatible with most word processing software. It's friction fed, and it features a page injector; an optional tractor is also available.

The EXP-500 (12 cps) is a 100 column letter-quality printer with the same specs as the EXP-550, but slower and without page inject.

EXP-550 (Parallel)	\$699.88
EXP-550 Tractor	\$139.88
EXP-500 (Parallel)	\$469.88
EXP-500 Tractor	\$129.88

NEC

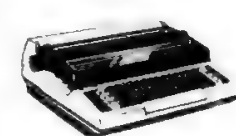
Spinwriters

The new 2000 Series are slower (20 cps), but they've retained all the quality of the 3500/7700 Series. Uses the same thimbles & ribbons.

2010/2030	\$879.88
2050	\$999.88
3530	\$1639.88
3550	\$1899.88
7710/7730	\$2159.88

SMITH-CORONA

Messenger



The Memory Correct III Messenger (the full name) is ideal for the home or small office. It combines the features of an electric typewriter and a letter-quality printer. It features 12 cps, 3 pitches (10, 12 & 15), variable line spacing, 10.5" writing line, backspacing & auto-correction. It comes complete with parallel/serial interface.

Memory Correct III Messenger	\$629.88
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Other Letter Quality Printers We Carry

COMREX

CR-1	\$849.88
CR-1 Tractor	\$104.88
CR-2	\$509.88
CR-2 Tractor	\$94.88

DIABLO

620 (RS-232C)	\$999.88
630 (PC)	\$1279.88

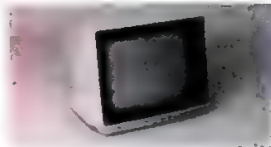
QUME

Sprint 11+	\$1539.88
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MONITORS

NEC

JB-1205/1201M



Slick design & slick specifications. The NEC JB-1205M is the amber version. The JB-1201M is the green screen. Both offer 80 columns on a 12" diagonal screen, with an 18-20MHz bandwidth and a crisp, clear display.

JB-1205M (12" amber) \$179.88
JB-1201M (12" green) \$169.88

USI

PI-3 (12" amber) \$189.88

AMDEK

300G (12" green) \$149.88
300A (12" amber) \$164.88
310A (12" amber) \$199.88

PRINCETON GRAPHICS

HX-12



The HX-12 is one of the finest RGBs available. 16 colors (using NEC's tube), 690 dots by 240 lines (480 Interlaced) & 15MHz bandwidth. Comes with its own cable.

PGS HX-12 \$499.88

QUADRAM

QuadChrome

The QuadChrome has the same spec's as the HX-12. Same price too.

QuadChrome \$509.88
Quadram Video Boards
QuadColor-1 \$199.88
QuadColor-2 \$219.88

USI/PARADISE

MultiDisplay

Supports 32K graphics, with composite, RGB, PC monochrome display and a parallel port.

MultiDisplay \$479.88

TECMAR

Graphics Master

192K for RGB or composite display, supporting 480 non-interlaced RGB output.

Graphics Master \$579.88

EAGLE COMPUTER

We are now offering both the Columbia MPC and the Eagle PC-2 to our customers. These machines are IBM-PC compatible, with 128K RAM on board, two 320K disk drives, one parallel port, two RS-232C ports and bundled software packages.

The Eagle PC-2 includes MS-DOS, CP/M 86, plus Eagle-Writer and EagleCalc. The Eagle PC-2 also includes a monochrome monitor, with a resolution equal to the PC monitor. The PC-2's ideal for first-time users. It's easy to learn & easy to use.

The Columbia MPC includes MS-DOS, CP/M 86, BASICA, Perfect Writer/Speller/Calc/Filer, Home Accountant Plus, Fast Graphs, Asynch Communications, a Macro Assembler, plus numerous utilities. This system is for more sophisticated users who have a PC at work and want a system at home or in a remote location.

Please call (603) 881-9855 for further specifications, price and delivery.

COLUMBIA

DATA PRODUCTS, INC.

MODEMS

DC HAYES

Smartmodems

The Smartmodems are originate/answer, auto dial/answer, full/half duplex modems. There are two external modems (300 & 300/1200 baud) & the 1200B (300/1200 internal for the PC). Modular phone cable & power supply included. (RS-232C cable is optional).

"Stack" Smartmodems
300 baud \$229.88
300/1200 baud \$539.88
1200B w/Softcom II \$459.88

US ROBOTICS

Password

The Password is an originate/answer type modem. 0-300 & 1200 baud capability with auto dial/answer, auto mode/ speed select, full/half duplex (local echo), audio phone line monitor. Comes with an RS-232C cable (specify male or female DB-25), power supply & modular telephone cable.

Password \$379.88

PERIPHERALS

AST RESEARCH

MegaPlus II

The MegaPlus has one RS-232C port, a parallel port, a clock & up to 256K RAM. An optional game and second serial port are also available. Comes with SuperDrive/Spooler software. The MegaPak is a 128K or 256K piggy-back card that attaches to the MegaPlus & gives you additional memory to 256K.

64K MegaPlus \$309.88
256K MegaPlus \$509.88
Options
256K MegaPak \$329.88
RS-232C Port \$49.88
Game Port \$49.88

AST RESEARCH

SixPak Plus

The Sixpak holds up to 384K on the board. Added to a 256K motherboard, you've got 640K, the maximum addressable memory. Sixpak has an RS-232C port, parallel port, clock & SuperDrive/Spooler software. An optional game port is also available.

64K Sixpak \$289.88
256K SixPak \$469.88
384K SixPak \$659.88
Game Port \$49.88

AST I/O Plus II

The I/O Plus II has one parallel port, one RS-232C port, one game port & a clock.

I/O+ \$199.88

RS-232C Port \$49.88

QUADRAM

Quadboards

The Quadboard has an RS-232C port, a parallel port, a clock & memory up to 256K (you can also get your Quadboard "naked," with no memory installed). QuadSpool/Drive software is included with every Quadboard, along with a one-year warranty.

Quadboard 0K \$219.88
Quadboard 64K \$279.88
Quadboard 256K \$429.88

Quad 512 +

Quad 512+ have a single RS-232C port on them, and sockets for up to 512K RAM. QuadSpool/Drive software is included.

Quad 512+ (64K) \$239.88
Quad 512+ (256K) \$439.88
Quad 512+ (512K) \$679.88

Single Function Cards

Parallel Card w/cable \$89.88
RS-232C Card \$89.88
Clock/Calendar Card \$89.88

QuadLink

QuadLink is like having an Apple computer on one board, with 64K. QuadLink takes up only one slot. Add \$20 for Columbia MPC or Compaq computers when you order.

QuadLink \$499.88

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- We accept CODs up to \$1000 (add \$10 handling fee per order) payable with certified check or money order. Company Purchase Orders are accepted on a limited basis & upon approval only. Sorry, no APO or foreign orders accepted. We have a \$50 minimum order.
- All our equipment is shipped with full manufacturer's warranty. We are an **authorized dealer** for all products we sell to insure full warranty support, & we're authorized for warranty work on a number of printers. We offer extended warranty plans for many printers.
- We prepared this ad in November, & prices do change, so call to verify them.
- For a catalog, send \$1 with your name, address and the type of computer system you own.
- Our **Computer Showroom** is now open in Amherst, New Hampshire, five miles west of Nashua (about one hour's drive from Boston).



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ALPHA SOFTWARE		
Data Base Manager II	295	199
APPLIED TECHNOLOGY		
Versaform	389	269
CONTINENTAL		
Home Accountant	150	105
Property Management	495	327
FOX & GELLER Quick Code	295	174
FUNK SOFTWARE Sideways	60	45
HOWARD SOFT		
Real Estate Analyzer II	250	165
Tax Preparer	250	165
HUMAN SOFT DB Plus		89
LIFEBOAT SYSTEMS		
Lattice 'C' Compiler		285
LIFETREE Volkswriter	195	119
Volkswriter deluxe		179
LOTUS — 1-2-3	495	316
MICROPRO Spell Star	250	162
Mail Merge	250	162
Super Sort	250	149
Calc Star	145	86
Info Star	495	320
Report Star	350	221
MICROSTUFF Crosstalk	195	129
MICROSOFT		
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Multitool Financial	100	69
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Letters To PC

Spacing Secrets

Many thanks for Paul Somerson's article "Why We Like WordStar" (PC, Volume 2 Number 6). I've been using a 3.24 version to write book length manuscripts for about a year, and wonder how I ever managed without it.

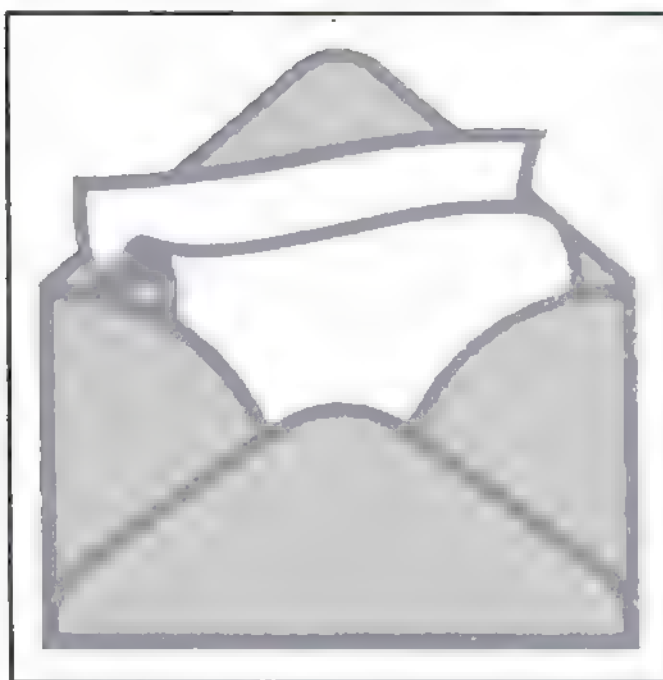
But why didn't Somerson reveal the secret code that will let us do proportional spacing? I use a NEC 350 Spinwriter, which is capable of proportional spacing, but I thought that WordStar wasn't. If I'm missing some undocumented features, I'd like to know about them.

James L. Schaaf
Columbus, Ohio

Paul Somerson replies:

You can get WordStar to print proportionally spaced text—sort of. Your printer, of course, has to be able to handle it. And there are lots of problems. You get a funny feeling when you look in MicroPro's WordStar customization notes and are confronted with statements referring to "The EXPERIMENTAL, UNSUPPORTED, and otherwise undocumented proportional spacing feature"

WordStar does contain a table of character widths that lets you drive a proportional-spacing printer by embedding a 'P' in your file. However, as MicroPro points out, "The relative widths only of characters are varied; the line length and number of characters on a line are left as formed by the editor. Thus optimum printout appear-



ance may not occur when a line contains an unusually large proportion of narrow characters, such as i's or .s, or an unusually large proportion of wide characters, such as M's and W's." In other words, good luck.

There are other problems, mostly with last lines of paragraphs and having to patch the character-width table for quirks in individual printers. If you need proportional spacing, try something like Final Word, unless you enjoy being glued to the screen for hours on end trying to make something work that probably never will. MicroPro is rumored to be adding true proportional spacing in a new WordStar release.

To Trust or Distrust

The November issue of PC Magazine contains a disconcerting pair of articles.

In "Mr. Norton, I Beg To Differ" (PC, Volume 2 Number 6), Greg Weissman criticizes Peter Norton's

earlier article about PC-DOS 2.0 ("The Dark Side Of DOS 2.0," PC, Volume 2 Number 2). Weissman charges that Norton's article was both inaccurate and superficial, citing chapter and verse.

Norton is given the opportunity of rebuttal. His response ("To Rate Or Berate," PC, Volume 2 Number 6) provides no defense at all against the charge of factual inaccuracy. In my judgement, Norton is no longer credible.

J. Walden Retan
Birmingham, Alabama

Peter Norton replies:

It's natural that many readers would think that my column in the November issue was in response to Greg Weissman's article. Actually, I first saw Weissman's remarks in print at the same time everyone else did. My column was not a reply to Weissman, but some general remarks about the touchy business of criticizing products.

I stand by the facts I reported in "The Dark Side Of PC-DOS 2.0." A number of PC readers have written to report problems similar to the ones I had. Perhaps the biggest complaint about my original list of reported errors is that I didn't conclusively demonstrate each problem. The simple fact is that it's the elusive bugs that slip by in testing; the bugs that are easy to document get fixed before a program is released to the public.

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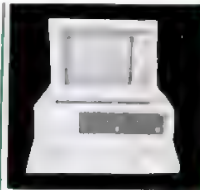
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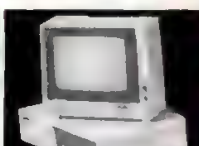
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LETTERS TO PC

hearing about the bugs I discovered in DOS 2.0, I'm keeping mum about the doozies I've uncovered in DOS 2.10. I still love DOS, though, believe it or not.

To Coin A Phrase . . .

We at Compu-Quote are pleased and grateful for the recent comprehensive review of our software package ("Counting Your Coins," *PC*, Volume 2 Number 6). Eric Freedman's article once again demonstrated his clear and objective writing style.

Your readers may be interested to know that just as Freedman hoped, we have upgraded and enhanced our program since his evaluation. *COINS* is now distributed with a revised 44 page manual and specific instructions for IBM PC and XT operation. Our Preview-Pack includes this manual and permits potential buyers to get an advanced look at the program.

Thanks for focusing on software for coin collectors.

Marvin Mellon
Compu-Quote
Canoga Park, California

Our Town

Our community, which numbers approximately 300 homes and a total population of slightly over one thousand, is considering the benefits of transferring all the necessary village records to some sort of computer program.

These records are varied but perhaps the two most tedious types are the ledgers that identify property values, taxes, owners of record, addresses, and all of the bookwork pertaining to the cost of maintaining police, road maintenance, and sanitation departments.

As a trustee of the village and the owner of an IBM PC-XT, I find that I am doing a lot of the work that would normally be done by our village clerk. I have been using *1-2-3* and *pfs:File*. I

have been looking through your excellent publication, going back almost to its inception, to see if anyone has generated a program devoted exclusively to municipalities, but to date I have been unable to find anything. Perhaps you know of such a program.

John P. Jennings
Mill Neck, New York

We know that there are such programs around, but weren't able to come up with any names for you. We invite readers who do know of specific programs to write in, and we'll pass on the information.—Ed.

A True Star

It was a pleasure to read Bill Machrone's review of the Hyperion computer, despite his gratuitous disparaging of chiclets and light bulbs ("The Hyperion Earns Its Star," *PC*, Volume 2 Number 5). As an 8-hour-a-day Hyperion user since May 1, I can heartily confirm his comment that "this is the way computers were meant to be."

The Hyperion's most striking feature for me is the thoughtfulness that is apparent in every detail, from the "softkeys" set up in common-sense decision trees, to the machine's discreet size and classy look, to the groove in the keyboard that is perfectly suited to hold hard copy drafts or stray pens. The "softkey" approach is really quite spectacular—as a beginner I was spared acquaintance with the silent "A:" prompt and hieroglyphic Ctrl KQs. As an old timer I rejoice in salvation from cluttering menus and superfluous gab. Also, having carted the Hyperion all over the world now without its ever needing service, I can vouch for its ruggedness and reliability.

Incidentally, Machrone's concern about the small size of the 7 inch screen is misplaced. There is no way I could be coaxed back to fuzzy, elephantine 12-inch screens after enjoying

the Hyperion's crisp 7 inches. Eye strain is now a distant memory.

As a diehard micro enthusiast, I do have one gripe. Now that I have 256K of memory with RAM disk, MYKEYs to remember my most intimate routine, an IN:TOUCH charged modem to do every conceivable communication gymnastic, Lotus *1-2-3* to graph every stray nugget of brilliance or budget, and IN:SCRIBE word processing to let me write faster than I can think—it's really tough to find any tantalizing new products that I might desperately need. Which reminds me, does anybody know of a good PC-compatible Mr. Coffee interface?

Martin E. Getendanner
Manila, Phillipines

Keeping Balance

Peter Norton touched on a vital issue in his column, "To Rate Or Berate": the question of whether a critic should castigate as well as praise. I believe critics have an obligation to inform the public. In the case of an operating system, program, or piece of hardware, a negative opinion voiced by a respected critic will go a long way toward saving a lot of people time and money.

When I read a review, I want to know what the product is supposed to do, what it actually does, and how well it performs. I want to know if human beings can understand the manual. I want to know the price. I want to know whether it's worth my time to investigate the product further, and I want to remember the review when I see the elegant advertising telling me that the product is the best thing to hit computers since the vacuum tube. That's where I need the guidance of Peter Norton and his fellow critics.

The argument not to berate because manufacturers are constantly improving and correcting is flawed. Do you know how slowly corporations move to make repairs and alternations when they are not absolutely required—and

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LETTERS TO PC

how quickly they react when the defects are exposed in print? Tell it like it is, Peter. In your article you indicated that you believe yourself and the magazine industry to be part of "the press." Can you imagine newspapers not reporting on law suits against Ford's Pinto or manufacturing defects by GM because both companies might be making the necessary repairs, or because the companies are heavy advertisers?

I want to know what *you* think, Peter Norton, not what the advertising manager thinks you ought to say. It will be interesting to see whose voice is heard.

Bernard Rabb
Frenchtown, New Jersey

MDBS Knows Better

Thank you for printing Frank Derfler's review of our product *The KnowledgeMan* ("Travels With KnowledgeMan," *PC*, Volume 2 Number 5). I would like to clarify several issues raised in the article.

First, *KnowledgeMan* runs not only under PC-DOS but on a variety of machines under CP/M-86, MP/M-86, and MS-DOS as well. This flexibility requires variations in the installation method across differing environments. Step-by-step installation instructions are provided, but due to the diversity of target environments they are necessarily generic.

Regarding documentation, a system as extensive as *KnowledgeMan* requires an extensive reference manual. An instruction manual will soon be available as a companion to the basic reference manual.

Regarding *KnowledgeMan* itself, Derfler was using an early version of the product, which did have the glitch noted in the review. The glitch is corrected in the current version (1.05), which also happens to be much enhanced and much faster than the version reviewed.

Derfler points out that the extensive capabilities of *KnowledgeMan* are furnished via a large number of overlay files. However, due to the integrated nature of these capabilities, it requires significantly less auxiliary memory than a collection of individual stand-alone packages offering similar features. Furthermore, users may not need to use all of *KnowledgeMan*'s facilities at once, thereby reducing the amount of disk space needed.

Because of integration with other *KnowledgeMan* facilities, particularly the data manager and the programming language, the 255 by 255 spreadsheet has a larger effective capacity than traditional spreadsheets. There is no need to clutter a *KnowledgeMan* spreadsheet with a lot of raw data and intermediate formulas.

One important facility not mentioned in the article is data security, an essential ingredient in most business applications. *KnowledgeMan* provides automatic data encryption, password checking, and read/write access controls for tables, fields, and cell definitions.

Gary J. Koehler
President and CEO
Micro Data Base Systems, Inc.
Lafayette, Indiana

Cache and Carry

How about a little comic relief from the usual scathing criticism and enlightening information?

One morning when I arrived at a client's office to work on a project, I found the computer was down. Client policy dictated that when a crash occurred, only the area managers would be told and all the other staff and consultants would get the word from them. This policy was implemented to relieve the operations staff of unnecessary phone calls and free them to concentrate on the problem.

I went to the area manager, a new man with field experience but no com-

puter background. He informed me that there was a "financial problem"; that was all he knew. Very puzzled, I decided to dare inciting the wrath of the operations staff to find out what the problem was. I went to the operations manager, who was not pleased. I explained to her that I had tried the other route, and told her what the area manager had told me about financial problems. She broke up and couldn't stop laughing for several minutes.

Finally, she told me the real reason that the machine was down, and it was my turn to laugh. A cache disk had been installed the night before, and there were several problems with it, causing the computer to go down. The "cash" disk was the cause of the financial problem!

Robert G. Gray
Vancouver, British Columbia

Doing It Right

How to read *PC Magazine*:

1. Remove all business reply cards, except for Reader Service Card, to use as coasters. Weigh issue. If weight is over 4 pounds (2 pounds after January 1), continue enthusiastically. If weight is 4 pounds or less, reassure yourself by hefting a *PC World*.

2. Evaluate cover. Look for Volume 1 Number 11 quality. If cover is similar to Volume 2 Number 3, reassure yourself by gazing at drab *PC World*.

3. Open to page 3 and look for page number. Look for a page numbered 14. Look for pages numbered 27, 53, 205, 419, 426, and 549. Found three numbered pages? Better than average.

4. Check page numbers again to confirm that they still have not been enlarged or moved to the lower outside corners of the page. What? They're fixed?! Unlock Shostak.

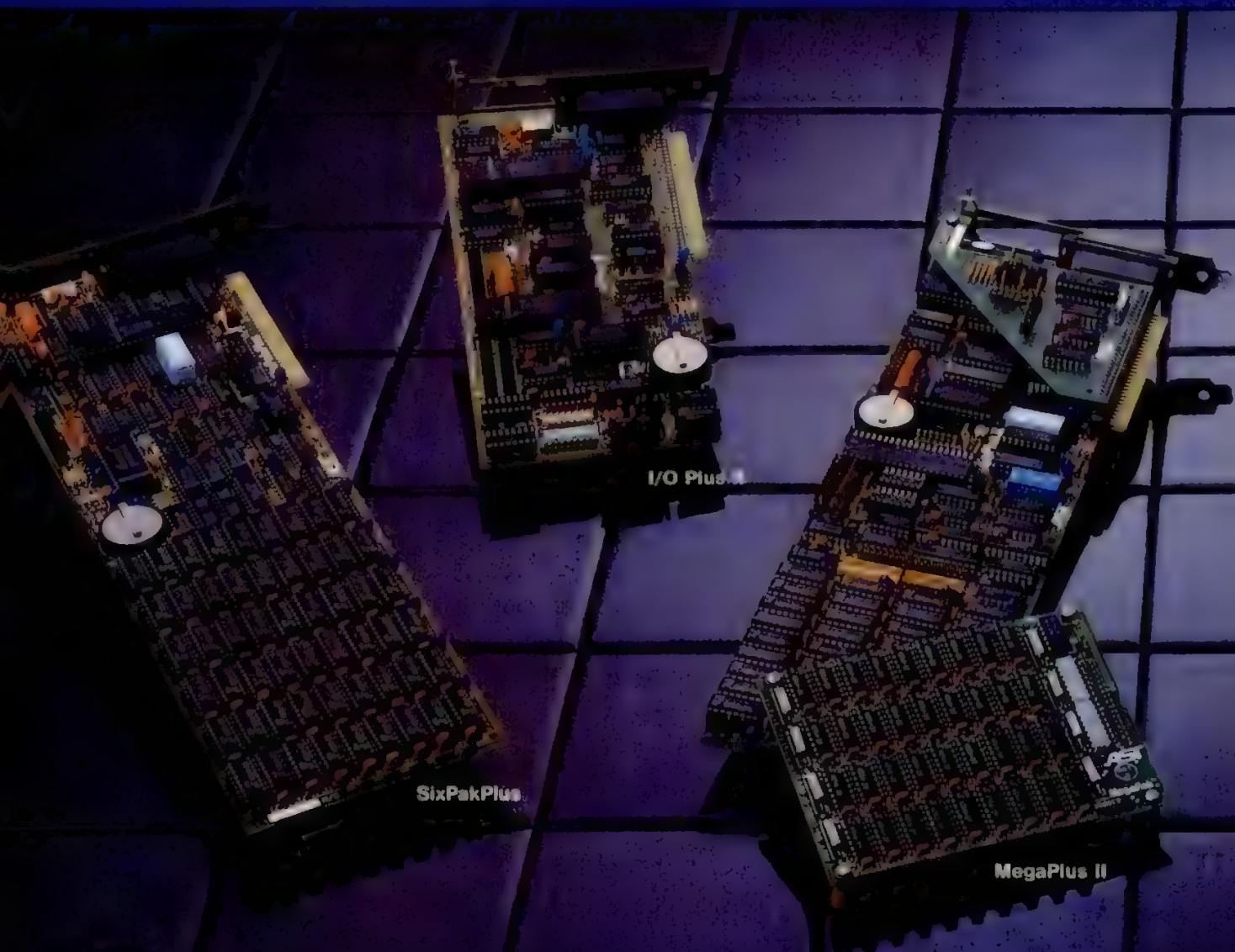
5. Glance over "Letters To PC" to look for your latest prose.

6. Read letters anyway. There may

With an AST Research Multifunction Board, you can realize the full potential of your IBM PC or PC-XT without wasting valuable slot space. By combining your memory and input/output requirements on a single card, you can take advantage of more of the capabilities IBM designed into the PC, while leaving space for future enhancements as they are introduced.

AST Research Multifunction Boards can add the following features to your PC:

- **User Memory from 64K to 512K** — When added to your existing system memory, brings your PC up to its maximum of 640K. This enables you to run larger spreadsheets, create larger in-memory databases, or you can use the additional memory along with the supplied AST SuperPak™ software for print spooling or for simulating floppy drives to increase your PC's throughput.
- **Serial Ports** — By connecting a modem to a serial (async) port, your PC can communicate with other computers over telephone lines. By connecting a serial printer, you can obtain high quality print output. Other serial devices such as a plotter or mouse may also be connected to a serial port. The PC allows for the installation of up to two serial ports.



Number One Add-On Products for IBM PC

Number One Add-On Products for IBM PC



Optional features may be added by the user at any time by installing an AST Research Upgrade Package.

All products come with extensive documentation as well as all necessary adapter cables.

	MEMORY	Serial Port 1	Serial Port 2	Parallel Port	Game Port	Bus Extension
SuperPak	X	X		X	X	X
MegaPlus II	X	X	X	X	X	X
I/O Plus II		X	X	X	X	X
ComboPlus	X	X		X	X	
MP Expansion	X					

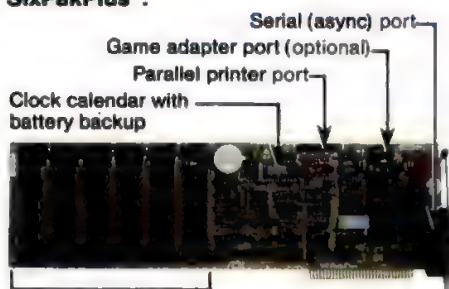
© 1988 AST Research, Inc. All rights reserved. AST-5251 is a product developed by AST Research, Inc. and Software Systems, Inc. of Jefferson City, MO. AST-3780 is a product developed by AST Research, Inc. and Milnet Systems, Inc.

AST Research Micro-to-Mainframe Communications Products:

- **AST-SNA** — A family of five products that enable a PC to communicate with a mainframe via the IBM SNA protocol without the use of protocol converters.
- **AST-5251** — An interactive 5251 remote workstation emulation package for use with the IBM System 34, 36, or 38.
- **AST-3780** — A hardware/software package which allows an IBM PC to communicate with a mainframe in 2780/3780 bisync protocol.
- **AST-BSC** — A hardware/software package that allows your IBM PC to provide all the features of a 3270 or 2770 terminal in bisync.
- **CC-232** — A programmable card that allows an IBM PC to communicate in async, bisync, SDLC or HDLC protocols.

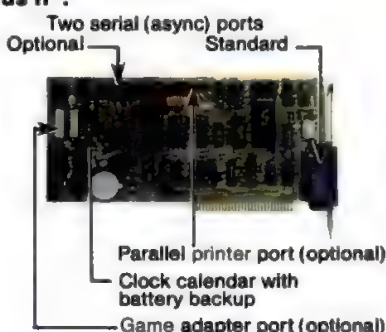


SixPakPlus™:

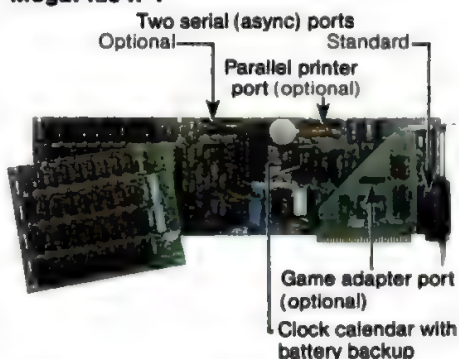


64K-384K of parity checked memory. Added to a PC or XT with a fully populated 256K system board, the SixPakPlus can bring the system memory to 640K, the maximum addressable user memory.

I/O Plus II™:

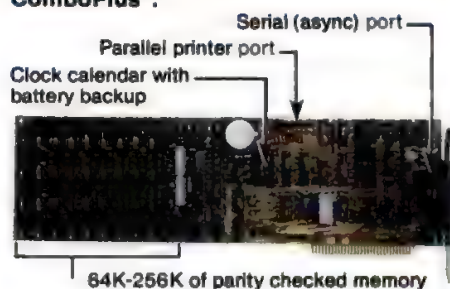


MegaPlus II™:



64K-512K of parity checked memory. The basic card expands to 256K, and with the MegaPak extension expands to an additional 128K or 256K of parity checked memory.

ComboPlus™:



MP Expansion Memory:



AST-PCnet™:



- CSMA/CD 1 Mbps baseband Local Area Network
- Uses standard 75-ohm CATV coaxial cable capable of running up to 7,000 feet
- Interconnects multiple PC's (57,000 addressable limit)
- All PC-compatible disk drives and printers are shareable
- Networked access to mainframes via shared AST-3780
- Users can execute commands remotely on shared PC
- File lock-out
- DOS 1.1 and DOS 2.0 compatible

AST
RESEARCH INC.

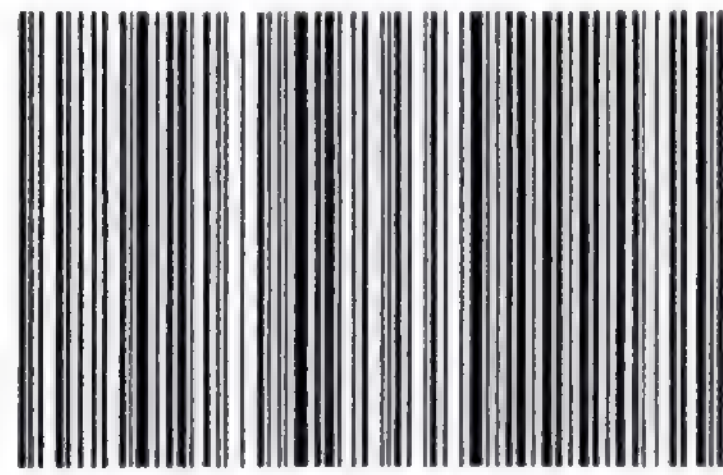
Irvine, California

(714) 540-1333 • (714) 863-1333
Telex: 295370ASTRUR

CIRCLE 154 ON READER SERVICE CARD

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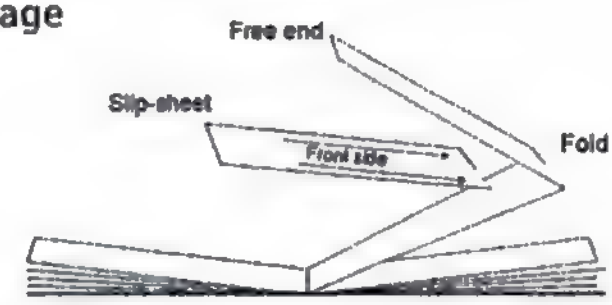
Inverted Foldout slip-sheet



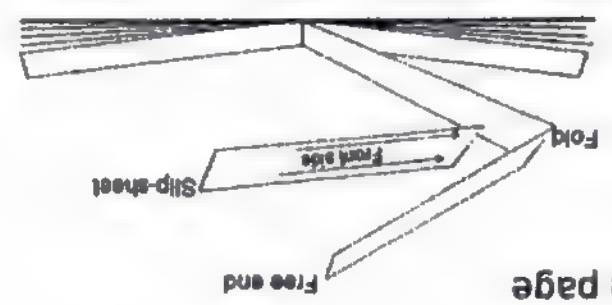
GbsSlipSheet-001

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

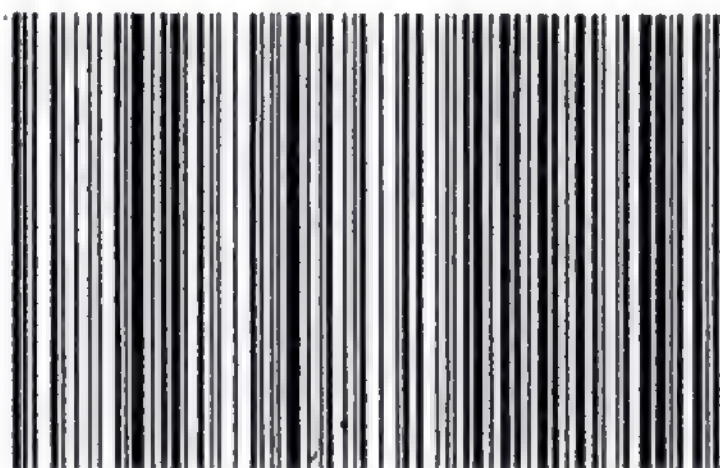


1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



GbsSlipBack-0018

Back

1. Follow instructions on the other side

Parallel Ports — The parallel port is used for connecting a parallel printer to your PC. A parallel printer typically uses a dot-matrix printout which is suitable for high-speed draft quality printouts. The PC allows for the installation of up to three parallel ports.

Clock-Calendar — With the on board battery, the clock-calendar feature will maintain the correct date and time, even when the PC is turned off. This feature eliminates the need for typing in this information each time you power up your computer.

Game Adapter — The game adapter port allows you to connect an IBM-type joystick to your PC so you can play the multitude of arcade-quality games which take full advantage of the PC's graphic capabilities. Or you

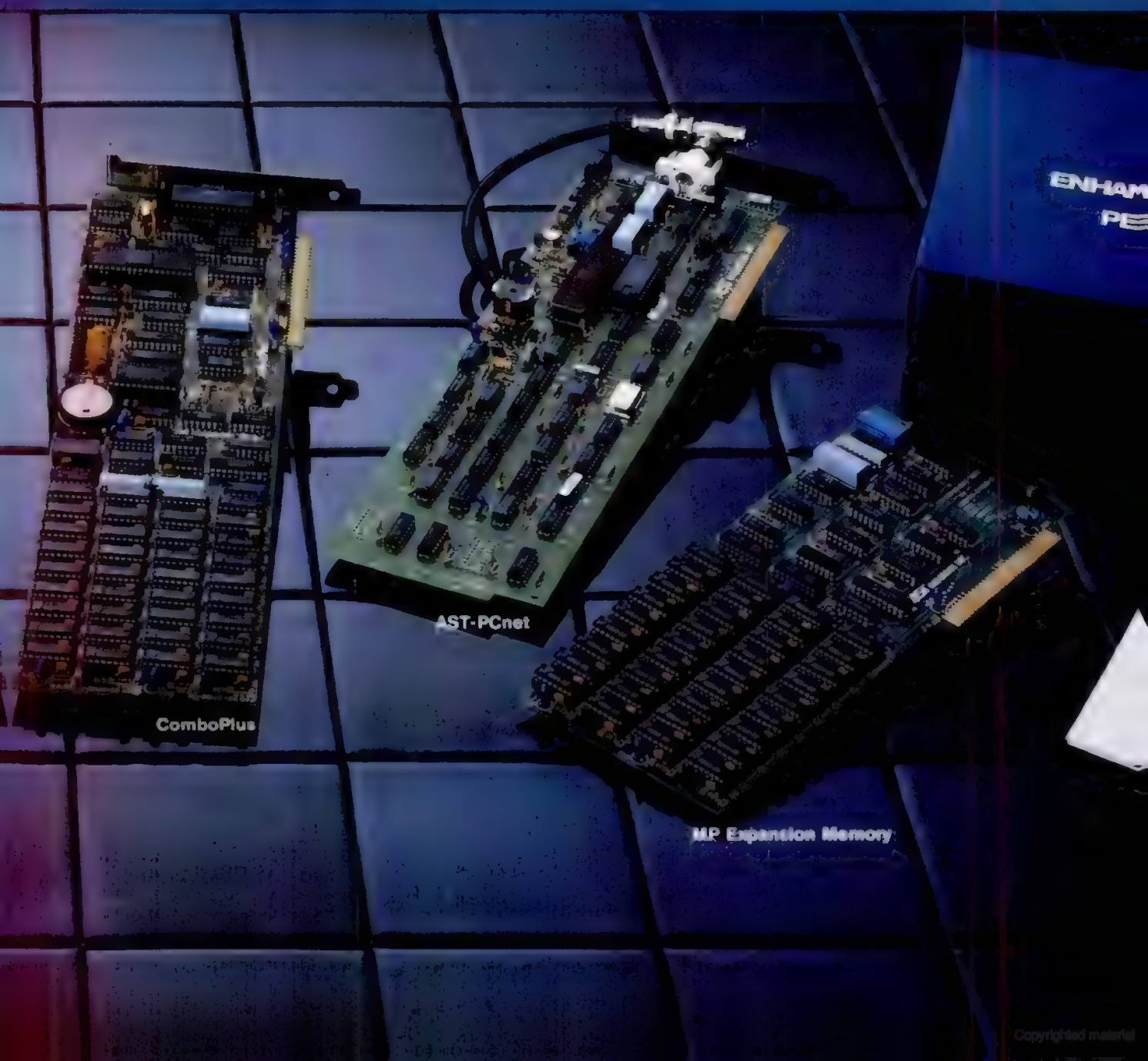
can use the joystick input for other applications by writing your own programs.

• **SuperPak** — Every AST Research Multifunction Board comes with an AST SuperPak diskette containing programs for setting and accessing the clock, as well as SuperDrive™ and SuperSpool™, the most powerful RAM disk and print spooler available for PC-DOS. With SuperDrive you can use your PC's memory for simulating one to four floppy drives, from 20K to 360K each. SuperSpool allows you to set aside memory (from 4K to 512K) as a print buffer; SuperSpool sends output to the printer in the background while you execute your program in the foreground. With SuperDrive and SuperSpool, you can significantly improve your PC's operating speed.

• **Proven Compatibility** — All AST Research hardware and software products are 100% compatible with all versions of the PC and PC-XT as well as the Compaq and other PC look-alikes, and are 100% compatible with PC-DOS 1.1 and 2.0.

• **Warranty** — All AST Research products are backed with a one year limited warranty covering parts and labor with an optional paid second year warranty available.

Of course, all AST Research Multifunction Boards come with the **AST "PLUS,"** our unsurpassed reputation for quality, reliability, after-the-sale support, and overall design excellence which give our products the best price/performance ratio in the industry!



ComboPlus

AST-PCnet

MP Expansion Memory

LETTERS TO PC

be one from A.C. Matthews or from J. Bennet.

7. Order back issues older than your subscription to get those three patches you have been needing.

8. Read "Hardware." See what equipment Rosch, Machrone, and Derfler got free this month.

9. Read "Software." See what software Derfler, Katz, and Woram got free this month.

10. Scan the table of contents for other hardware and software reviews.

11. Find and read all reviews, even those on hardware you don't anticipate ever needing and especially on software you don't have, just in case.

12. Read Norton. See what subject he is applying his Carl Sagan imitation to this issue.

13. Read Weissman (Volume 2 Number 6) to Purge Norton from your system. This is the physiological equivalent of Ctrl-Alt-Del.

14. Read Zachmann. Contrast to Norton (who?).

15. Read "PC Arcade." See what games Sandler is playing free this month.

16. Read Somerson. See what he's wrong about this month.

17. Read Van Gelder. Call PC Network and buy what she's selling this month.

18. Read Fastie. See what portion of *PC Tech Journal* he thinks you can understand this month.

19. Read Derfler. See what is practical this month.

20. Read Machrone. See what he thinks is neat this month.

21. Read Rosch. See what is neat this month.

22. Read Sandler. See what's up in *PCjr Magazine* this month.

23. Read cover stories.

24. Read "Languages." Ignore Lee's APL articles, but puzzle through any source code, just in case.

25. Read "PC Tutor," word . . . for . . . word. Key in all Zachmann's

patches and save to disk, even if you don't have the problem.

26. Read "User-To-User." See what readers think Machrone will think is neat this month.

27. Read "PC-Communiqués."

28. Read "Applications," just in case.

29. Abandon the Table of Contents and read the rest of the issue cover to cover, skipping ads, "New On The Market," "PC:Bluebook," and "Club News."

30. See which Tecmar ad is on the back cover.

31. Remove the Reader Service Card.

32. Read all ads, noting new ones on Reader Service Card.

33. Read "New On The Market," noting new products on the Reader Service Card.

34. Mail Reader Service Card.

35. Read "PC:Bluebook," just in case.

36. Check "Club News" for local user groups. Renew pledge to join.

37. Key in all remaining patches and program listings, saving to disk, just in case.

38. Add to budget *PC Disk Magazine* subscription.

39. Read *Car & Driver* letters section for new letter idea.

40. Resume weight training to prepare for the next issue of *PC*.

41. Reread Weissman (Ctrl-Alt-Del) to be sure of Norton purge . . . just in case.

William N. Allred
Towson, Maryland

A Better Letters Plea

"Letters to the Editor" columns, in my opinion, are intended to provide a forum for the opinion, commentary, and review of the readers. After receiving my tenth issue of *PC Magazine*, I have noticed a disconcerting pattern in "Letters To PC."

Now don't get me wrong. I am

quite satisfied with *PC* as a total package. The articles are good and the mail order ads have saved me a bundle. The monthly exercise doesn't hurt either. It's just the letters column that I object to.

By my calculations there have been about 158 letters published in the ten copies of *PC* that I own. Fully 37 of these (23 percent) do not fit my above definition of letters to the editor. In any single month, the split ranged from 9 percent (Volume 1 Number 10) to 40 percent (Volume 2 Number 6). These 37 letters fall into two categories: rebuttals of previous *PC* product reviews by the product's manufacturers, and purely new product-plugging by a supplier.

I would much rather see more independent commentary and fewer manufacturer's addresses. If articles submitted on specific hardware or software require rebuttal by the manufacturer, it would be more appropriate to begin a new section specifically for this purpose.

To fill the gap in "Letters To PC," I encourage independent PC users to speak out. Let us, the readers, know what you are thinking.

Kevin J. O'Connor
Center Valley, Pennsylvania

The editor of "Letters To PC" is glad to see a reader speaking out for her favorite cause, and she hopes that Kevin J. O'Connor's fellow readers will be moved by his request to write prolifically and eloquently.—Ed.

Corrections

In *PC*, Volume 2 Number 6, an incorrect phone number was printed for Term Computer Services, manufacturer of *Mr. Math Money Tutor* (page 528). We are working on obtaining the correct number; in the meantime, please *do not* call the listed number. You can write to the company at the listed address, P.O. Box 725, New Providence, NJ 07974.



25 Mb the hard way.



25 Mb the Rana way.

CIRCLE 533 ON READER SERVICE CARD

14 REASONS WHY THE PARADISE MULTI-DISPLAY CARD IS SELLING FASTER THAN WE CAN MAKE THEM.



1. More performance, dollar for dollar. Paradise Systems, Inc. delivers a color display controller, monochrome display controller and printer interface *all on a single card.*
2. Compatible with IBM® PC/XT and the best productivity software. You can work with all the great IBM productivity packages, like Lotus 123™.
3. Standard monochrome display with no additional software: Fully IBM compatible. All the clean, fully-formed characters you'd expect from IBM.
4. High-resolution color graphics: Fully IBM compatible. 640 × 200 black and white; 320 × 200 medium resolution; 4 colors.
5. The best working display available for IBM. Flicker-free scrolling—even in color.

6. External switch for easy selection of monochrome or color mode on system startup without having to open the machine.
7. Switches easily between monochrome and color modes under software control.
8. IBM character sets and text modes. Paradise delivers character sets identical to IBM offerings. (9 × 14 character box for monochrome and 8 × 8 character box for color/graphic modes.)
9. Built-in fully compatible IBM type printer port.
10. Use two cards for simultaneous display. Two Multi-Display cards—or one in conjunction with an IBM video card—give you the ability to perform simultaneous display on two screens.
11. Individually selectable horizontal and vertical sync polarities: Compatible with the widest range of RGB monitors.
12. Illustrated manual with step-by-step instructions.
13. Fully IBM compatible light pen and RF modulator ports.
14. Separate connectors for easy function changes without changing jumpers. The Multi-Display Card has separate connectors for monochrome display; composite video; RGB video; parallel printer; light pen; and RF modulator.

It's no wonder the Multi-Display Card is in such high demand.

Look for the Multi-Display Card from Paradise Systems, Inc. at your local computer dealer. Call (415) 468-6000 or write to 150 North Hill Drive, Brisbane, CA 94005, for more information.

CIRCLE 484 ON READER SERVICE CARD
IBM is a registered trademark of International Business Machines Corporation.
Lotus 123 is a trademark of Lotus Development Corporation.

PARADISE
SYSTEMS, INC



Introducing the First 2.5 Mb Minifloppy Drive.

Isn't it just like Rana Systems to introduce a floppy disk drive for the IBM® with the mass storage benefits of a hard disk, plus the floppy's strength of removable media. The first minifloppy that stores an incredible 2.5 megabytes on a single diskette. Imagine, storing a word processor, a spelling checker, mailing list, and dictionary on one floppy. With megabytes to spare.

Rana's new drive needs only 10 floppies to give you all the capacity of five 5-megabyte hard discs. But that's not the limit. In fact, there is no limit. Like any floppy with its removable media, you can use diskette after diskette to increase your storage. Our expanded capacity disk drive not only acts like a hard disk, it also serves as an ideal back-up for one.

And that's just the beginning, because Rana's drive introduces totally new "closed loop servo" minifloppy technology, making the drive insensitive to temperature or humidity. Rana's controller card can be used with standard internal drives also, so you don't have to

use an additional slot. Our drive comes with its own power supply, software enhancements for PC-DOS 2.0 and 1.1, and CP/M-86®, and a box of diskettes. Everything you'll need to make your IBM operate to its maximum potential.



The new 2.5 megabyte minifloppy drive, available first for the IBM® PC and XT and soon for the Apple®. It's Rana's latest proof that to stay a step ahead, you've got to lead the way.



Rana Systems

CIRCLE 548 ON READER SERVICE CARD

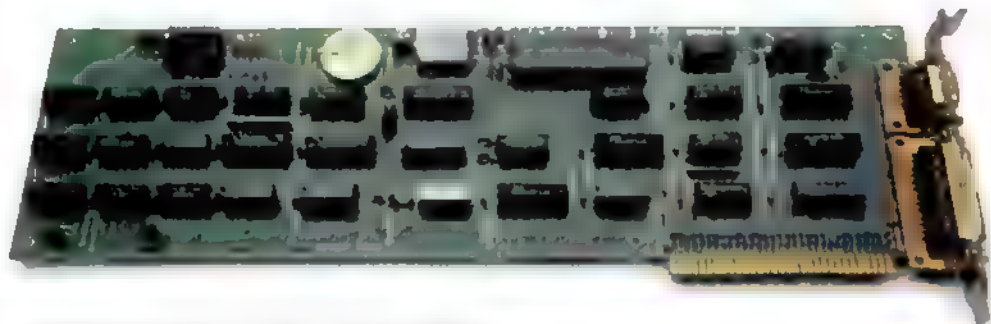
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21300 Superior Street, Chatsworth, CA 91311 213-709-5484 For dealer information call toll free 1-800-421-2207 In California only call 1-800-293-1231 Source Number 161-883 Available at all participating Computerland stores and other fine computer dealers.

IBM is a registered trademark of International Business Machines Corp. CP/M-86 is a registered trademark of Digital Research. Apple is a registered trademark of Apple Computer, Inc.

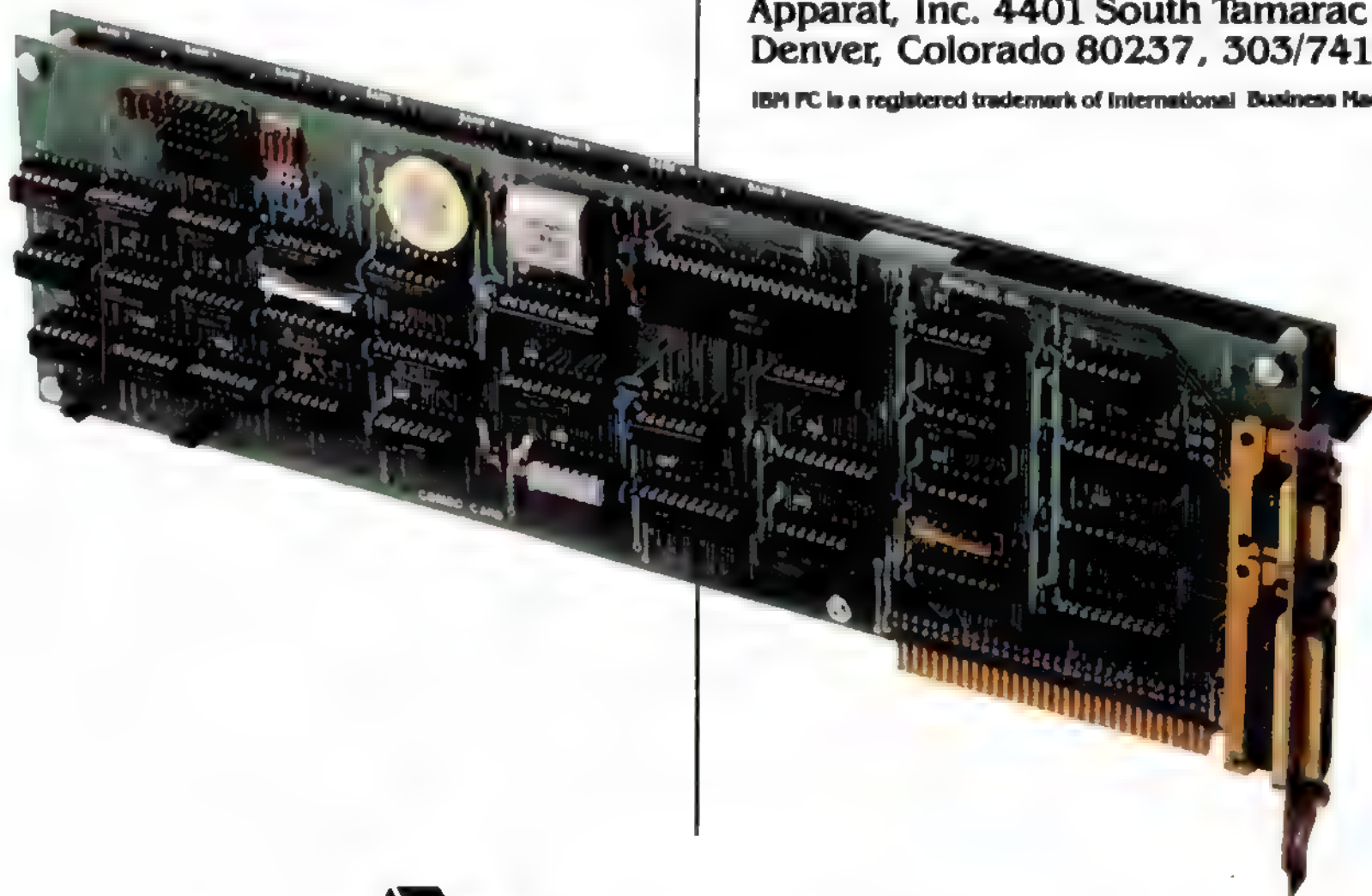
THE ONE AND ONLY CRAMBO

You've got a problem. Go to your favorite computer store. Ask to see their Combo Cards. Then ask about their RAM Cards. See the problem? Just too many to pick from. Now, ask to see the CRAMBO™. No problem. There's only one. Ours. Except you don't know what a CRAMBO is. You've probably guessed it's a Combo Card piggy backed to a RAM Card. So it only takes up one slot in your IBM/PC. That's right. But here are the details.



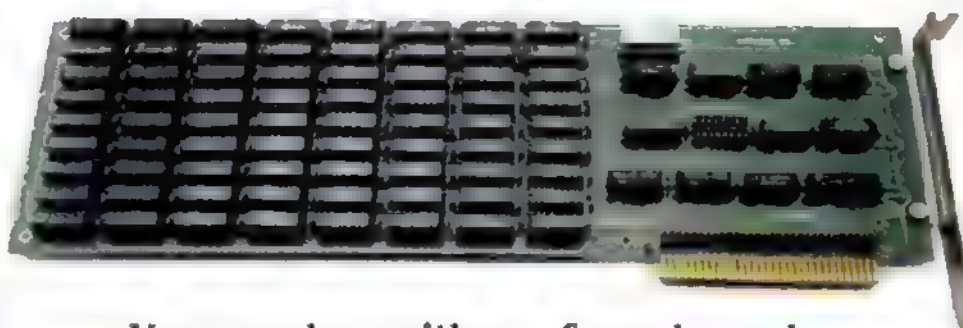
THE COMBO II CARD:

For **\$189** you'll get a Clock Calendar, Async Communications, Parallel Printer and a Game Adapter.



THE 512K RAM CARD:

It too, is only **\$189** with 64K of RAM installed. And when you need more RAM, 64K increments are available for \$64 each. And, SDRIVE, the electronic disk emulator, is available at no cost with the RAM Card.



You can buy either of our boards separately for use in the XT or PC expansion chassis. But only our boards can be piggy backed to give you the one and only CRAMBO. And for only **\$359**.

Go check out the CRAMBO at the same store carrying all those Combo Cards and RAM Cards. If they don't have the CRAMBO have them call us. **800/525-7674**. Or write: Apparat, Inc. 4401 South Tamarac Parkway, Denver, Colorado 80237, 303/741-1778.

IBM PC is a registered trademark of International Business Machine Corp.

 **Apparat, Inc.**

CIRCLE 118 ON READER SERVICE CARD

**Only one
program handles
all your funds
and investments
and trusts
and partnerships
and business ledgers.**

One. Alone.

Only MoneyTrack lets you—or your secretary—keep your books for all accounts, business and personal, with one program. All funds, investments, trusts, and all your business ledgers. Everything. Simultaneously.

Only =MONEY=TRACK= does it.

No other financial program for personal computers can do it. You'd need two, three, maybe four; and you'd still have to tease and trick them into doing the things MoneyTrack is already programmed to do easily.

Even then you wouldn't enjoy MoneyTrack's greatest benefits. Because having everything in one program gives you unmatched flexibility.

For instance, only MoneyTrack lets you do a cross-analysis of both business and personal income and expense. You can track tax-sensitive accounts—like interest income/expense and capital gain/loss—across every one of your ventures.

This, and much more—only with MoneyTrack.

Is =MONEY=TRACK= for you?

It's specifically designed for those with multiple sources of income, varied interests. The entrepreneur, investor, business manager, general partner, developer; those with a small business, farm, retail store, professional practice.



For you, MoneyTrack is not only the best program, it's the only one that makes sense.

What's more, you don't have to know anything about bookkeeping, and the very minimum about computers. MoneyTrack's "big system" programming takes care of you.

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MoneyTrack is under \$350. And to know what it's worth, you must see how much it does for you.

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Or call us, and we'll arrange it for you.

Pacific Data Systems, Inc., 6090 Sepulveda Blvd., Culver City, CA 90230. (213) 559-8713.

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Quiet, reliable, compatible
No special mounting brackets required

•All 5 1/4" drives come with complete installation instructions and all necessary brackets and screws. Drives come configured as drive A or B for your PC

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.....\$ 699

dBase II/Quickcode\$ 559

Wordstar Propack/dBase II/

Lotus 1-2-3\$ 1049

FEATURE SPECIAL

AST Sixpack w/384 k installed
Comes with Serial, Parallel Port
Clock Calendar, Superspool, Superdrive
and Lotus 1-2-3

For Just \$ 869

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Disk Drives

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(Includes power supply controller card and software)

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Full Size 320K DS/DD\$ 235

Half-Height 320K DS/DD\$ 195

TEAC, Hitachi, Matsushita

Half-Size 320K DS/DD w/brackets\$ Call

Slimline 640K DS/DD w/brackets\$ 310

Scotch/3M DS/Diskettes (box of 10)\$ 39

Expansion Boards

AST Research

(All AST boards come with SuperDrive, Superspool, and one year warranty)

SixPack Plus (See Specials of the Month)\$ 269

MegaPlus II 64K (upgradable to 256K, or 512K with

Megapak) with clock calendar and serial port\$ 265

MegaPak 256K upgrade for Megaplus\$ Call

I/O Plus II clock calendar and serial port\$ 115

Memory Upgrade Set (9 chips) 64K\$ 55

Connectall Bracket for extra cables\$ 20

Option Kits for AST Expansion Boards

parallel, serial, game port\$ 35

Hercules Computer

Graphics card (parallel port)\$ 349

IRMA\$ Call

Maynard Electronics

Modular Disk Controller Card\$ 219

Standard Disk Controller\$ 165

with serial port\$ 219

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Serial Module\$ 90

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Competitive prices, prompt service, and complete support.

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Smartmodem 300	\$ 209
Smartcomm communications software	\$ 99
Smartmodem to IBM six foot cable	\$ 25

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MicroStuf

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PRINTERS

C. Itoh

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Printmaster F10-55PU 55cps	\$ 1695

Epson

RX-80 F/T Graphtrax II	\$ Call
MX-100 F/T Graphtrax II	\$ Call
FX-80 F/T Graphtrax II	\$ Call
FX-100 F/T Graphtrax II	\$ Call

NEC

Spinwriter 3550	\$ 1895
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Okidata

Microline 83A F/T 120 cps, 132 cols	\$ 625
Microline 92 160 cps, 80 cols	\$ 495
Microline 93 F/T 160 cps, 132 cols	\$ 795
Microline 84 F/T 200 cps, 132 cols	\$ 990
All printer cables	\$ 30
Plug n' Play (Epson emulation ROM chips)	\$ Call
We carry a full line of printer accessories	

MONITORS

Amdek

Video 300 Green (Graphics card)	\$ 155
Video 300 Amber (Graphics card)	\$ 165
Video 310 Amber (monochrome card)	\$ Call
(we supply cable for all Amdek monitors)	

Princeton Graphics

PGS Hi Res RGB Monitor with cable	\$ Call
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USI

Pi2 Green (Graphics Card)	\$ 155
Pi3 Amber (Graphics Card)	\$ 165
MultiDisplay Card	\$ Call
(We supply cable for all USI monitors)	

SOFTWARE

ATI

All Training Software	\$ 50
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Ashton Tate

dBase II	\$ 385
Friday	\$ 179

Fox & Geller

Quickcode	\$ 169
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Financier

Personal Series	\$ 129
Tax Series	\$ 119

IUS

EasyWriter II	\$ 205
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Lifetree

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Volkswriter Deluxe	\$ Call

Lotus Development

1-2-3 (with tutorial on disk)	\$ Call
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Multiplan	\$ 160
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Multi-Tool Word (with mouse)	\$ Call

Micropro

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WordStar/MailMerge/Spellstar (Propack)	\$ 389
(Newest versions, 3.3)	

Lattice

C Compiler	\$ 325
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GAMES

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High Quality Text Games	
Zork I, II or III	\$ 29
Starcross	\$ 29
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VisiWord/Spell	\$249.00
Visitrend/Plot	\$199.00
VisiFile	\$199.00
VisiSchedule	\$199.00
Desktop Plan	\$199.00
Business Forecast Model	\$75.00
StretchCalc	\$75.00
VisiTutor Calc	\$59.00
VisiTutor/Advanced Version	\$75.00
VisiTutor Word	\$59.00
Vision Calc	\$249.00
Vision Graph	\$129.00
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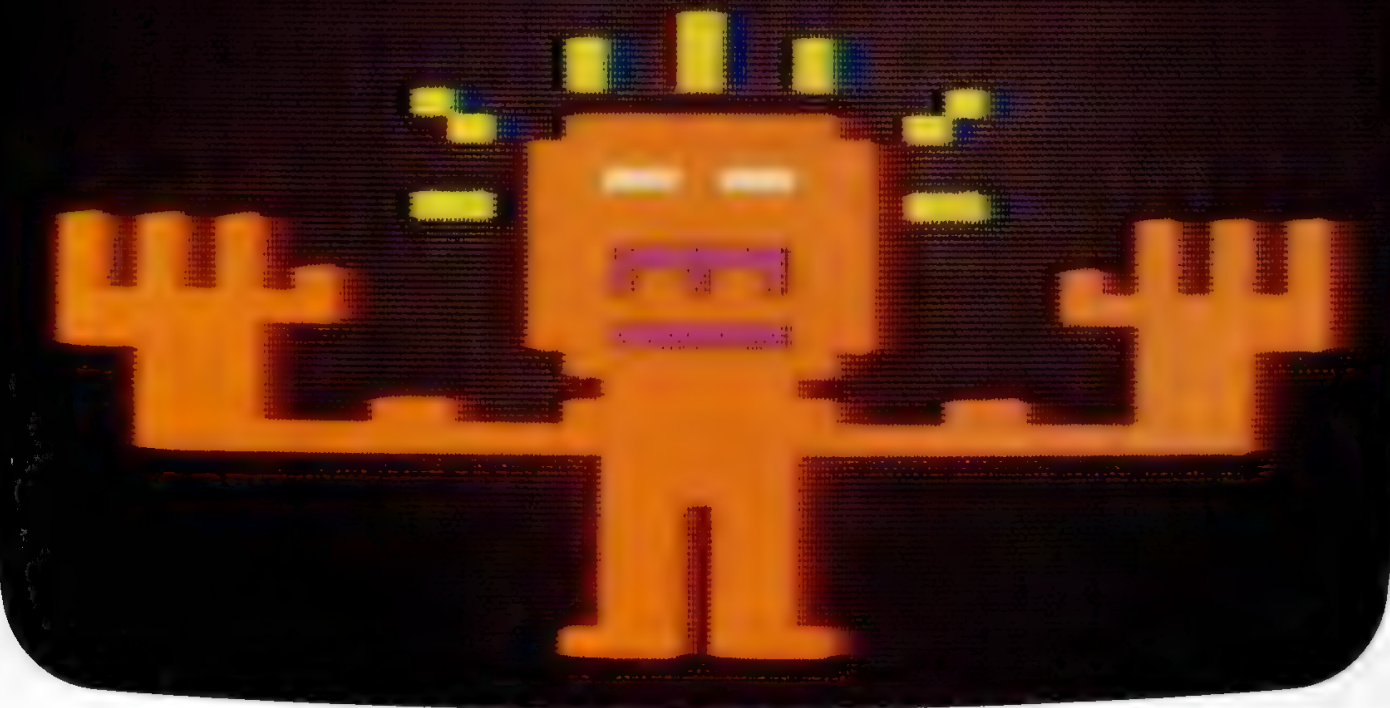
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A View From The Ivory Tower

To his own great surprise, a professor buys an IBM PC and starts to learn some of the rules of the computer world. Here, he recounts his trials and tribulations as a computer novice.

The first thing I saw this morning upon waking was my IBM PC suffused with the glow of the morning sunlight. At first I thought I was dreaming. What would I be doing with a computer in my house? I've had my PC for only a few months, and I'm still in awe of it. Perhaps in another few months the novelty will wear off. Perhaps.

Not many months ago, I was oblivious to the microcomputer craze that is sweeping the country. I made (and make) my living by teaching students to observe the subtleties of Emily Dickinson's poetry and the rules governing point of view in fiction writing. I did not expect that I would be ready for the subtleties of a computer, but I was.

In February 1983, the head of my department at the university received a flyer concerning an upcoming conference on Computers in the Humanities. He dropped the flyer onto my desk and said, "This might be a good one for you." He is always urging me to attend conferences, and I never oblige. But this time, he took my silence as consent and arranged for me and another member of my department to attend the conference.

We attended a fascinating lecture on the future of computers, learned about accessing bibliographic databases, and witnessed a demonstration of videodisks.



For the first time in my life, I held a computer (an Epson) in my hands.

Several weeks later, I was appointed to a committee studying the feasibility of purchasing microcomputers for the university. At first, the discussions that took place during the meetings confused me, but after a few weeks, I was catching on—and catching computer fever.

Developing an Obsession

The committee deliberated all spring and by summer had decided to purchase an IBM PC for the campus. At the same time, I was deliberating with myself (a committee of one) about the possibility of adopting a personal computer of my own. Adopting is the right word here. I got it into my head that I wanted an IBM com-

puter, even though my budget said no.

My fever had developed into an obsession. I found myself making frequent visits to the computer stores, buying all the current issues of the computer magazines in order to study the advertisements. After class, I began detaining students whom I knew to be computer science majors so that I could talk hardware. There was no turning back.

Although the university's agreement with IBM included the promise of discounts on PCs purchased by faculty, the details would not be worked out until September when the campus' machines were scheduled to be installed. My problem was that I wanted my own computer as soon as possible. I knew that I would need the summer to train myself on the machine. I toyed with the idea of getting a PC through a discount mail-order firm, but my wife restrained me. Thanks to her calming influence, I decided that a September delivery would do fine. But, as a concession to my fervor, I decided to get my printer right away so that there would be no delay once the machine did arrive.

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GUEST EDITORIAL

The computer finally arrived on September 28. I had to hook it up to the printer myself, which worried me, as I am generally not too good with machines (even my Nikon camera sometimes defeats me). I was pleased to discover that I could print what was on the screen by pressing the Shift and PrtSc keys, but to attempt anything more ambitious, I had to wait a few days for my *WordStar* to arrive from a mail-order house in California.

Receiving *WordStar* was one of the happier moments of my preoperational existence. I installed the software by following the manual's instructions closely. I answered the questions as they appeared on the screen, which seemed simple. Feeling confident, I began creating files and I enjoyed my newfound sense of power. But when I tried to print my first file, I ran into difficulty: There was no response to the print command. I followed the diagnostic procedures to determine the problem, but couldn't make it go.

I called the computer services personnel on campus, but even they could not explain what had happened.

Learning a Lesson

At this point I learned an important lesson about the computer world: You can't get a satisfactory answer by telephone. I spent a week calling various offices around the United States. The IBM office in New Jersey referred me to the Product Center in Philadelphia, which in turn referred me to the people in the Radnor, Pennsylvania office who were responsible for making the arrangements with my university. I called the Boca Raton office and the Diablo technical assistance line in California. Finally, I tried the mail-order firm in California that had sold me *WordStar*.

Somewhere along the line, I inherited a piece of false wisdom. I was told that the Diablo printer, being a serial device, would need an asynchronous communications adapter board in order to work. Numerous technical people assented that this was true. Even the technical people at

IBM admitted that that was probably the problem and that without it the printer would never work.

In the face of spending several hundred dollars more in an already strained budget, I conferred once again with the computer personnel on campus who suggested that I exchange printers. They gave two reasons: First, it would be cheaper than spending the extra \$200. Second, if I purchased a NEC 3550, I would have the same hardware as the university and technical problems would be easier to answer.

I then understood the first law of modern computing: There are so many computers and printers and varieties of software that it is difficult, if not impossible, for even the specialists to deal with all the potential problems.

I exchanged my Diablo for a NEC. I went through the *WordStar* installation procedure once again. This time I selected the NEC option instead of the Diablo when the appropriate question was asked. By this time I had quite a few files opened on various floppy disks; it was just a matter of getting the information to paper. On my first attempt, the printer started pounding away and I was jubilant—but too soon. The machine did print, but not correctly. One line printed clearly, but the characters in the remaining lines came out condensed as a single character at the left margin.

After several fruitless evenings, a member of the computer staff on campus came home with me. We went through the *WordStar* installation again and the result was still the same. We gathered up my floppy disks and headed back to campus. Since the university had the same system, I could test out the software on its machines to try to isolate the problem.

I booted up the machine, inserted *WordStar*, and gave the print command for the same file; the results were perversely gratifying. The same gibberish came out. I believed that the problem was probably in the disks rather than in my machine at home.

Someone in the office had his own

copy of *WordStar*. I borrowed the disk and attempted once again to print out my file. The NEC produced a beautiful copy. The problem, then, was in the *WordStar* installation—not in the computer or in the disks.

The owner of the *WordStar* disk volunteered that when he had installed his program, he had simply used the default values for every question in the procedure. When the program stated that the printer currently installed was an IBM Parallel Printer and asked what kind of printer he was installing, instead of stating the truth (NEC 3550), he simply hit Return.

I followed his advice and went through the installation procedure once again—and it worked. I took it home and it worked there, too, and has worked ever since. I don't understand why, but I don't ask questions.

There was yet another surprise in store for me. I still had the Diablo at home, so I hooked it up to the PC and attempted once again to print on it. This time, to my surprise, it worked as well. I kind of wish that it hadn't, because I had to decide which printer to keep. Though the Diablo seemed a more substantial machine, I decided on the NEC because the characters were better looking.

Seventeen days elapsed between the time I had the needed hardware and software and the time that I actually began word processing. I must admit that I was on the verge of many drastic acts, including returning the computer to its source and reaffirming that I was a book man. But the PC has changed the way I write and increased my productivity. I can't imagine life without it.

The colleague who went to the conference with me was not converted. As a matter of fact, he has taken to putting up anticomputer cartoons on his office door.

I can't figure it out, but I don't care. I'm not looking back. ■

Michael Clark is a humanities professor at Widener University, in Pennsylvania.

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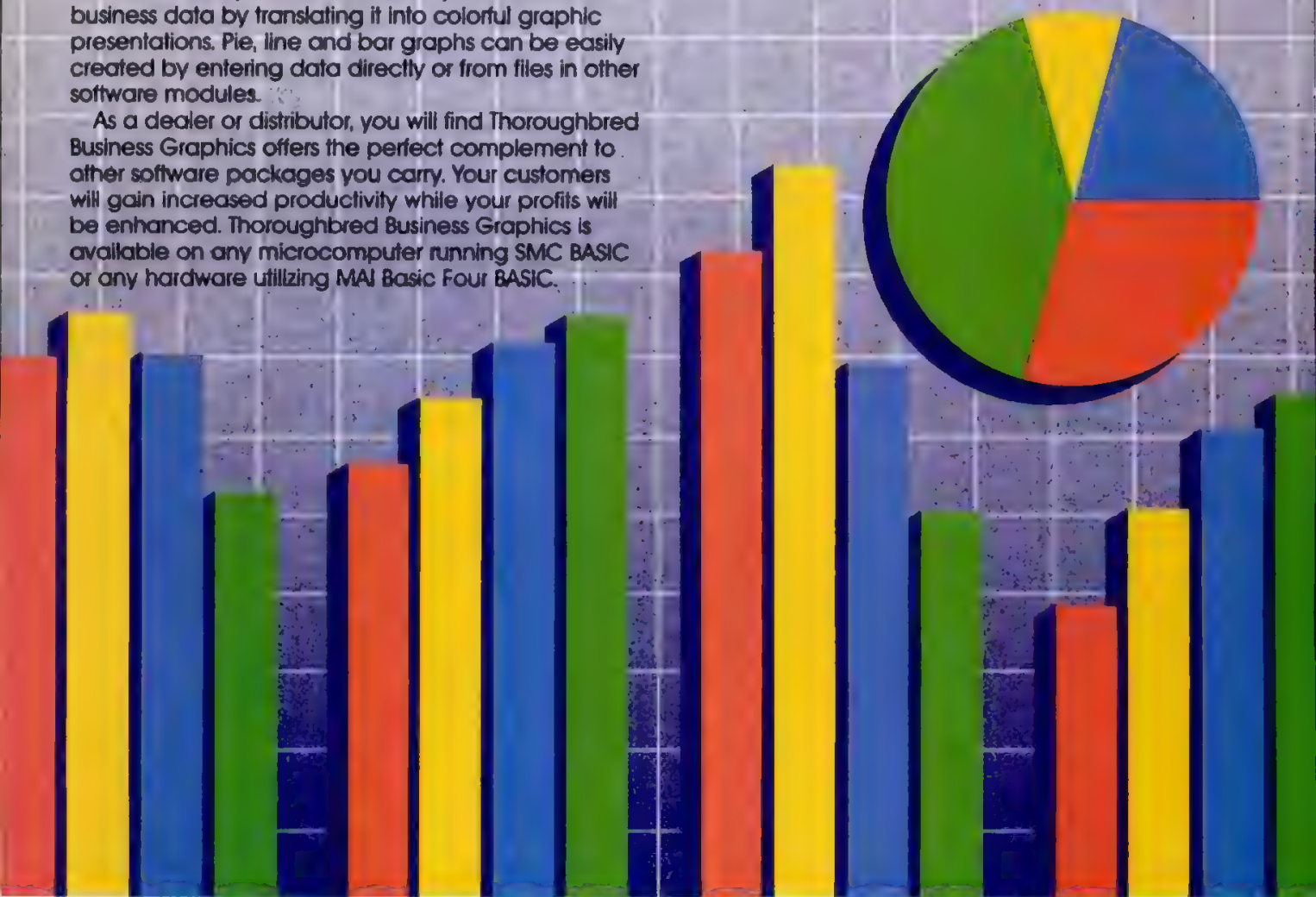
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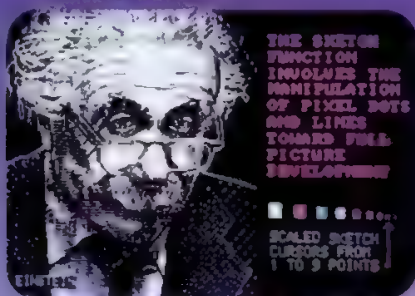
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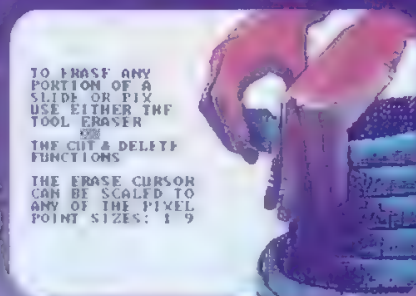
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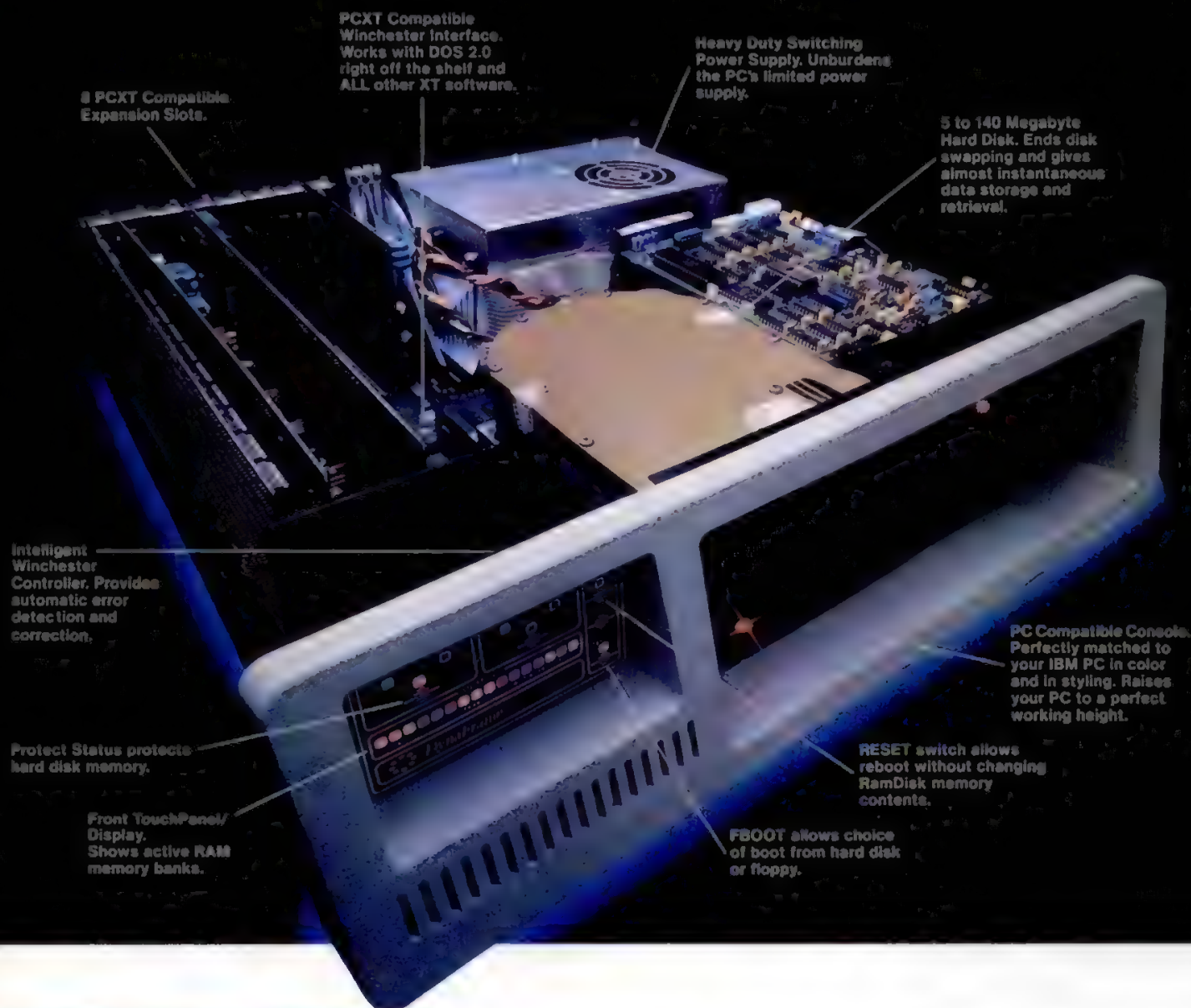
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Mainframe Migration And More

The appearance of Realia COBOL will speed up mainframe migration. The publication of *Word Proof* means fewer misspelled words. But what does DOS 2.10 mean?

If your business requires the computing power of a mainframe, wouldn't it be great if you could use your PC for running applications programs written in COBOL for IBM's 370 series computers? In the following discussion, we'll take a close look at a COBOL compiler that makes this eminently feasible. We'll also give a preview of IBM's *Word Proof* and a peek at the darker side of DOS 2.10.

Moving mainframe applications programs to PCs—mainframe migration—is possible in large measure because most mainframe computer programs are written

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Peter Norton

in high-level languages, such as COBOL or Fortran, that aren't completely tied to the computers that they work on. In theory, (sometimes even in practice!) a COBOL program will work on any computer that has a COBOL compiler. Difficulties arise when a computer has its own variation of the programming language; Honeywell COBOL isn't the same as Univac COBOL, and so forth. The greater the differences, the harder it is to move the programs. Unfortunately for microcomputer users, our desk-top computers usually have been equipped with programming languages that diverge considerably from their mainframe cousins—a major obstacle to moving mainframe programs over to microcomputers.

There are a great number of good reasons for the phenomenon of mainframe migration. IBM has supported the process in a strong way with its new XT/370 model of the PC. The XT/370, more than an ordinary XT, has the special ability to run unaltered versions of most of the important applications from IBM's 370 series of mainframe computers.

Mainframe Power

The XT/370 provides a great deal of mainframe computing power at a tiny fraction of a mainframe price. The XT/370 provides up to half the power of IBM's 4331 model for a price in the neighborhood of \$15,000. Though \$15,000 is a lot more than pocket money to most of us, it's petty cash to any company that can afford IBM's larger mainframe computers. There is nothing unusual for a single computer user in a large company to rack up \$15,000 in computer-use charges each year, or even each month. If the same money were used to purchase an XT/370, which can do the same work month after month at no extra charge, then the savings would be enormous.

In addition to the heaps of money saved, we know of another benefit of mainframe migration: the possibility of personal computing. Doing mainframe-level computing work on an XT/370 gives us all the advantages of personal comput-

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VENIX/86 is from VenturCom, the leading UNIX software development company, which pioneered UNIX for microcomputers. They tailored UNIX for the IBM PC to optimize memory usage, speed, and system reliability. The standard distribution includes: four editors, a C compiler, BASIC, an assembler, yacc and lex. Plus UNIX to UNIX system communications (UUCP and CU), document preparation (nroff), a spelling checker, a table formatter, a wide range of library routines, and more. VenturCom even remembered the UNIX aficionado by including the UC Berkeley enhancements vi, termcap, more and the c shell. Electronic mail, calendar and reminder functions are, of course, standard. The hard disk can be partitioned to permit both UNIX and PC-DOS files. So look no further. *VENIX/86* is a complete and faithful UNIX implementation.

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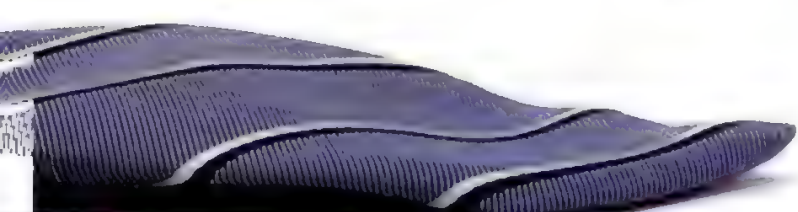
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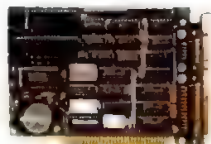
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ers: convenience, control, intimacy, and more. So there are both dollar advantages and practical work advantages in migrating computing work from mainframes to personal computers.

While that may look dandy to companies that find XT/370s ever so affordable, you and I might blanch at spending \$15,000 for a spiffier personal computer. Where do we stand, then, in trying to move our computing work from a mainframe to a PC or any other micro?

Mainframe COBOL for the PC

One potential solution to the problem is products such as Realia COBOL, from Realia, Inc., in Chicago. Since IBM's 370 series dominates mainframe computing and since COBOL dominates commercial programming, the Realia people had a simple but inspired idea: They decided to produce a COBOL compiler for the PC that exactly matches the features of IBM's 370 COBOL. The idea is terrific, if it works. (The few simple—but inconclusive—tests I've done on an early version of Realia COBOL look good.)

One interesting fact about Realia COBOL's development suggests that it ought to be a very good product: the Realia COBOL compiler is written in COBOL and compiles itself very quickly. There is nothing unusual about compilers being written in their own language, at least for programming languages like Pascal and C. For COBOL, however, it's very unusual, since most people don't think of COBOL as suitable for writing things like compilers. I find it wonderfully refreshing—programming snob that I am—to see the sophisticated task of writing a compiler done in COBOL. It's nice to see something done that you thought was nearly impossible.

Programmers tend to really polish and refine the programs that they use themselves. I've often thought that if DOS had been developed completely on PCs, we would have seen a cornucopia of wonderful programmer's tools included along with it. That this didn't happen gave me

my own opportunity to develop the Norton Utilities; if DOS had been written with DOS on PCs, programs like mine would

Desk-top computers usually have been equipped with programming languages that diverge considerably from their mainframe cousins.

have been made part of DOS. This line of reasoning makes me think that Realia COBOL is likely to be a really good compiler—after all, since the Realia folks have to use it too, they probably put a lot into it, and everything that makes it better and more useful for them makes it better for us as well.

Whether or not Realia COBOL succeeds, it represents a very important development for the world of IBM personal computers. The appearance of compilers that exactly match mainframe languages should make it possible for us all to move a substantial proportion of our mainframe applications to desk-top computers (without paying the price of an XT/370). I hope that we will see all the most important mainframe languages exactly duplicated on our PCs.

How Do You Spell Success?

Item two: three cheers for some wonderful software. Every so often—and it's less often than I'd like—I find a piece of software that makes me jump for joy. My latest leap (don't get me wrong—I'm only leaping, and speaking, figuratively) was over a spelling checker with IBM's name on it: *Word Proof*.

Word Proof meets my two informal standards for software excellence: First, it's worth the price you have to pay for it,

and more. Second, it works so well and is so aesthetically pleasing that you say to yourself, "That's what software should be like." *Word Proof* scores high on both counts.

Though this isn't the place for a full review of *Word Proof*, here's a quick summary of why I'm so pleased with it. First, it's well-engineered, which makes it easy to use and fun to watch while it's doing its spelling check. Second, it incorporates a nice little editor, so that when a spelling error is found, you can fix it (or any other part of the text) without leaving the spelling checker. The person who first recommended *Word Proof* to me liked its editor so much he uses it as his main editor (with the spelling checker as an added luxury). Third, *Word Proof* gives suggested correct spellings for any suspect words—which made spelling corrections very easy. As an extra goody, *Word Proof* will find synonyms just as easily as corrections for misspelled words.

Word Proof is on IBM's list of programs that work on the PCjr, which is good. Unfortunately, the big dictionary that *Word Proof* uses can be slow on a diskette. There may be more wonderful spelling programs, but this is by far the best I've ever used.

And, finally, item three: In the July 1983 issue of *PC Magazine*, I wrote an article melodramatically titled "The Darker Side of DOS 2.00," in which I reported a host of difficulties that I encountered using this version of the important operating system. It's been a source of both amusement and amazement to me how much controversy that article generated. In fact, all these months later the controversy still hasn't died down.

I always like to be warned of problems that I might stumble across in my work, but apparently many PC readers do not, at least when it concerns their (and my) favorite operating system. Never let it be said that I don't respond to the voice of the people. Here's my report on the darker side of DOS 2.10: *I've found some doozies, but I ain't tellin'.*

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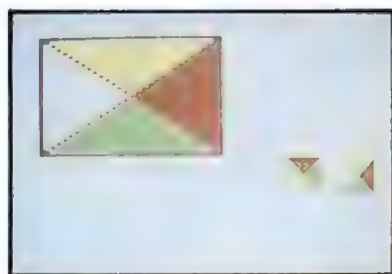
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Apple Charts The Course For IBM

Will Apple Computer recover the number one position in the microcomputer field from IBM? Probably not, but Apple's original formula won't be forgotten.



As observers of International Business Machines Corp. are aware, the strongest competition to IBM in the professional personal computer market is Apple Computer, Inc. When IBM announced the Personal Computer in August 1981, Apple was the dominant manufacturer in the business and professional marketplace—the target marketplace for the IBM PC—and although IBM has largely supplanted Apple as the premiere firm in this area, Apple remains a strong contender in the market.

It is ironic that IBM owes much of its present success to the work done by Apple Computer when it was striving to attain the number one position in the field. The marketplace now serviced by the IBM PC was developed around the Apple II computer; IBM was able to take advantage of the change in the professional public's perception of microcomputers from toys to essential business aides, inspired by the Apple II's performance. Further, IBM correctly analyzed the elements of Apple's success and emulated them by altering its own traditional approach to marketing and development to compete in this marketplace. It is even more ironic that Apple now seems to have forgotten the lessons that it taught IBM so well.

By now, anyone who has read anything about computers knows something about the early history of Apple Computer, Inc.—how it was founded in a garage by two young men with complementary genius, Steve Wozniak, an engineer without a college degree working for Hewlett-Packard, and Steve Jobs, who had previously worked for Atari and travelled through India. Wozniak was, and is, an engineering genius. Jobs was the entrepreneur who saw a market niche for such a product and understood what would appeal to consumers. The initial product, the Apple I, quickly gave way to the Apple II, which was technically superior to anything yet developed and soon was the impetus for the proliferation of microcomputers throughout society.

To properly appreciate the ironies of

the IBM-Apple relationship, it is necessary to demythologize the incredible Apple success story, without diminishing the genius or accomplishments of Jobs and

The Apple II became the impetus for the proliferation of microcomputers throughout society.

Wozniak. Apple did not, contrary to some of its advertising, invent the personal computer. It did, however, bring to market a personal computer that was superbly engineered, well-packaged, and expandable by other manufacturers. It was certainly the first company to combine all of these elements in one machine, and this combination of features proved strong enough to spawn the industry that IBM entered in August 1981.

Right Place at the Right Time

If Apple was not the first firm in the business, then what catapulted it to the forefront? The primary reason, we believe, was that many independent developers of software and hardware chose to develop and market their products for the Apple II rather than other machines. There were many apparent reasons for the choice.

First, Apple was a serious company and developers had reason to believe that it would be around for a while. This confidence stemmed from the company's ability to interest such well-known venture capital firms as Venrock and Arthur Rock in investing in Apple.

Second, the Apple II's packaging did not make it look like a ham radio operator's hobby kit. A low heat-generating switching power supply allowed the computer to be placed in a lightweight plastic case. Its sophisticated packaging differentiated it from the S-100 computers that had visible boards and wires connecting vari-

ous components to the motherboard. Regardless of the manufacturer's intention, the S-100's appearance gave the impression that it was aimed at hobbyists and that you needed to understand electronics to properly use it.

Third, the Apple II offered options that no other computer offered. It was the first of its type to provide usable color graphics. It contained expansion slots for which other hardware manufacturers could design devices that could be installed into the computer to perform functions that Apple has never even considered. This feature, coupled with the fact that the computer was "open," was probably the most important factor to the technical developers of hardware. The Apple II could thus be used with communications devices, large mass storage controllers, analog/digital converters, video and speech digitizers and synthesizers, and other devices.

Also, following the introduction of its disk controller, Apple was, for a period of time, the only computer manufacturer able to provide its purchasers with disk drives. This was an important factor to software developers that wished to design disk-based software.

Fourth, Apple was rapidly able to develop a superb distribution and retailing network without spending a great deal of money. The company was in the right place at the right time and managed to get in on the ground floor of an entirely new business: personal computers. A sub-industry, including early retail chains such as ComputerLand, grew up around Apple. Further, Apple was able to use independent distribution networks, such as CCM in Boston, to handle its dealer distribution until it was in a position to take on these aspects of the business.

All of these factors caused independent developers to select Apple as the vehicle with which to ride to market. Looking back on those days, Dennis C. Hayes, founder of Hayes Microcomputer, Inc., said, "We chose the Apple II because of its expansion slots and openness and because its packaging was better oriented

Can Anybody Tackle IBM?

This essay, reprinted from a British news magazine, gives a detached and concisely written view of the volatile American personal computer market.

The personal computer business was started seven years ago in a Californian garage by two penniless young men. One of them is now among the 300 richest people in America because Apple Computer, whose capitalisation in its garage days was \$1,300, today does a billion dollars of business a year. It is a strength of the computer industry that this kind of thing happens. But the giant awaits. Every computer technology matures with extreme haste; and at the end of every maturation there is IBM.

Most people have grown used to IBM's grip on the big computer (mainframe) market. Even in the 1970s, when its hand was stayed by a web of American lawsuits, IBM never held less than 60% of the worldwide mainframe market; that figure is now above 70% and rising. But more people are astonished that IBM has devoured almost 30% of the American market for personal computers, even though it started from scratch only in 1981.

Personal computers are small enough and cheap enough (at \$2,000-6,000 each) eventually to be put on the desks of most workers who earn their pay by manipulating words or numbers. They make a mass market that IBM, used to dealing with mainframe grandees, was thought unsuited to tap. Instead IBM has not just tapped the American market. It is storming through it. Europe has so far been spared this blitzkrieg, but only because IBM cannot make personal computers fast enough.

One result is that some personal computer companies, of which there were once as many as 200 in America, are starting to drop dead. In itself this is good news. What is needed in the early stages of any industry is too many people, with

plenty of different ideas, rushing in to try to do the job. A broad range of experiments implies a large class of failures, so a rash of bankruptcies in a young industry is a normal and welcome thing.

Awkwardly, IBM is enjoying this success in personal computers at the same time as it has been unleashed from its American antitrust worries. So it is increasing its attack on computer and communications markets across the board. This raises the question: can anybody compete with IBM? Answer, yes.

What IBM has really done in the American market for personal computers, and is about to do for home computers, is not to make competition impossible, but to set a standard that those who hope to compete will usually have to follow. Most personal computers sold in America after 1983—no matter who makes them—will contain the same microprocessor chip as IBM's personal computer does, use the same low-level software to control the machine's operation, and be capable of running the same applications programmes such as word processing.

The Standard Dilemmas

Before IBM came on stage, a swarm of different personal computers was being sold, most of them incompatible with one another—ie, they could not swap information or use the same software. Customers prefer a single standard. That is a main reason why IBM now has a larger share of the American market than any other company and why it is likely to come out top in Europe as well.

Two objections are made to this kind of standardisation. The first is that it interferes with technological progress. This is true, but it is not very damaging.

Americans have a wide choice of personal computers. Many of them are technologically better than IBM's, but the customers have still gone for IBM's machine. In consequence, some bright ideas will not immediately be translated into products. Once those ideas have a plain commercial advantage, however, they will be.

The second objection is that an IBM standard gives IBM an unfair advantage. It does not, though it may seem to. IBM has geared up to compete in nearly every line of the computer business, from tiny home computers to mainframes. It is absent only from the markets for supercomputers used for scientific research and weather forecasting, a line that IBM was beaten in and gave up. It also seems ready to move into the communications business, especially the part that involves connections between computers within a single office. The chances are that in all these lines IBM's way of doing things will become everybody else's standard. Will it therefore have the upper hand in them all?

There are two ways a standard can be established. One is the way it has now been done in the American personal-computer business. The other is for a large number of companies to sit down together and agree on a standard. European computer companies like the committee approach. They are wrong. Standardisation committees usually drone on for years before they produce anything. They are especially useless when IBM stays aloof, as it usually does. It is better to let the market decide a standard.

Paradoxically, Good for Japan

The main reason why an IBM standard is not worrying is that it can help

Can Anybody Tackle IBM? (continued)

competition to flourish. IBM will soon be as much a prisoner of its own standards as its competitors are. Once enough IBM machines have been bought, IBM cannot make sudden changes in their basic design: what might be useful for shedding competitors would shake off even more customers.

It is true that, in the 1970s, several American companies, called plug-compatible manufacturers, tried to make equipment that shadowed IBM's machines—and went broke. The EEC commission claims in its antitrust case that IBM has held back technical information that would allow other companies to design machines to fit with its own.

Japanese computer-makers will probably be the greatest beneficiaries of an IBM-standardised world, though they do not think so now. Still bruised by their quarrels with IBM over the theft of its trade secrets, and still only on the doorstep of the American personal-computer market, Japanese companies are feeling tentative. Their shyness should be short-lived. A market for a standardised personal computer will play to the customary Japanese strengths of high-quality production at low cost.

These are not the signs of an industry about to topple into a monopolist's hands. Concentration comes swiftly to the computer business, even to young lines like personal computers. But so too, because of its very fast technological pace, do opportunities for new attacks by outsiders. There are plenty of people ready to take on IBM, including AT&T, which will start in January. It is better that they, rather than lawyers or bureaucrats, should strive to cut IBM down to size.

This article is reprinted, with permission, from the November 26, 1983 issue of The Economist, a British weekly news magazine.

toward the less computer-sophisticated customers—our primary target.”

Early Apple Programs

Of all the products created for the Apple II, the most important was *VisiCalc*. Developed by Dan Bricklin and Bob Frankston, the founders of Software Arts, and marketed by Dan Fylstra's Personal Software (since renamed VisiCorp), *VisiCalc* was introduced in May 1979. Jack B. Rochester and John Gantz, in their book *The Naked Computer*, consider that date one of the nine “Great Moments In Software.” They describe the software package as: “the first program an inexperienced computer user could really operate.

... It's probably the most influential program since Fortran.” *VisiCalc*, when introduced and for approximately the next 12 months, was only marketed for the Apple II computer. People entered computer stores to purchase *VisiCalc* and something to run it on. *VisiCalc* cost \$100, and the “something to run it on” (an Apple II) cost anywhere from \$2,000 to \$10,000, depending upon the hardware configuration.

Benjamin M. Rosen, now chairman of the board of Compaq Computer and at that time an early proponent of Apple Computer and *VisiCalc*, made a prophetic comment in the *Morgan Stanley Electronics Letter* of July 11, 1979: “So who knows? *VisiCalc* could some day become the software tail that wags (and sells) the personal computer dog.” And this is exactly what happened. Apple's main rivals in the professional marketplace, Radio Shack and Commodore, never recovered. Other software developers saw the dramatic sales of the Apple II and rushed to get their programs to market for the same computer. Programs such as *Tiny Troll* (the forerunner to *VisiTrend* + *VisiPlot*), *CCA Data Management*, (the forerunner to *VisiFile*), *DBMaster*, and *EasyWriter* appeared only for the Apple. By the time Software Arts was able to release the Radio Shack and Commodore versions, the rest of the major software for the professional middle

and upper manager had appeared only for the Apple. The independent dealer network was in place and extremely loyal to Apple. Radio Shack ended up competing with Apple mainly for the small business market, while Commodore competed mainly in the educational area. While both firms continued to make protestations to the contrary, it was apparent to most observers that Apple had the large firm customer market locked up.

It is interesting that the programs mentioned above were also among the first to be released for the IBM PC, and that the direct descendants of *VisiCalc*, the *MBA* and *1-2-3* provided the first valid reason for the Apple owner to purchase an IBM PC. Other programs that ran on both machines performed equally as well on the Apple, and some, such as *VisiCalc*, actually ran better on the Apple.

IBM's Little Mainframe

While the Apple success story was unfolding, IBM kept an arm's length from the personal computer field and concentrated on its acknowledged strengths—mainframes and, to a lesser extent, minicomputers. IBM did have a desktop series, the 5100, but as personal computers, these machines were dismal failures. Even though the systems were sold directly to end users, they were the antithesis of user-friendly. They were actually little mainframes and used data processing terminology rather than English, wherever possible. The disk drives were designated “80” and “40” rather than A and B or 1 and 2, and, to make matters worse, 80 was the equivalent of A on the PC. Additionally, no third-party software available for the system was recommended by IBM. The 5100 series led people to wonder whether IBM could differentiate between small business and personal computers.

It rapidly became apparent to industry analysts that IBM would have to alter its traditional marketing and product development practices if it planned to compete in the personal computer marketplace. Analysts also felt that to succeed in the

personal computer market, IBM would have to become competitive.

Apple III Backfire

Apple did not sit on its hands waiting for IBM to join the battle. It instead attempted, by introducing a new machine and new dealer policies, to cement its position as number one in the microcomputer world. Unfortunately, most of its efforts in these areas backfired. The new machine, the Apple III, was expected to function as a high-end Apple II and had many features that the Apple II did not, such as 80 character screen display with upper and lowercase capability, up to 256K memory, and over twice the internal speed of the Apple II. It was released with an operating system called SOS and a new adaptation of BASIC called Business BASIC, both of which appeared superior to anything that existed in the microcomputer world. It also included a version of VisiCalc and software that would allow the III to emulate the II and to run software written for the II. On the face of it, it looked like Apple Computer would have another winner.

But there were early quality control problems with the machine, and the word spread through the industry that it was unreliable. The emulation feature proved to be incomplete—many peripheral cards, such as the Hayes Micromodem II, did not fit properly into the system and were unusable. The internal clock announced for the system never worked and was finally abandoned. And SOS proved to be of more value to technicians than to end-users, who were intimidated by it.

The attitude within Apple concerning the III seemed to waver between pomposity and paranoia. Criticism was dismissed as "lack of understanding" or as unfriendliness to Apple. The Apple III Project Manager said of the problem with the Micromodem: "We consider that Hayes' problem, not Apple's." Apple knew the III was technically superior to the II; it had better system software and even better packaging. It was only logical that soft-

ware authors would develop products for the III, and that prospective customers would run out to buy it.

Apple was so committed to the III that it dedicated the majority of its develop-

Apple seems to have forgotten the lessons that it taught IBM so well.

ment dollars to it. The company virtually ignored the II, which it felt would begin to phase out of the market. For example, it developed a 5 megabyte hard disk, known as the Apple Profile, for the III in 1981.

Apple's misreading of the marketplace caused some dealer consternation. It became difficult at times to obtain IIs, while the initially hard-to-get IIIs became commonplace, because very few were being sold.

Dealer resentment was also building for other reasons. Apple had begun to talk seriously about "National Accounts Programs," in which Apple would go directly to Fortune 1000 companies to ensure true national sales support and service. Dealers such as Datal Stores and Future Information Systems, both of New York City, were already serving Fortune 1000 firms and interpreted the projected programs as direct competition from the manufacturer of the system that brought them the majority of their revenue.

Dealers were also concerned by the price pressure being brought to bear on them by firms in New York City that were not affiliated with Apple as licensed dealers but were obtaining Apples from dubious sources. Because of lack of overhead, these "gray-market dealers" were able to sell the systems at greatly discounted prices. The licensed dealers felt that Apple was not doing enough to find the unlicensed dealer's supply source and close it down. When dealers responded to such price pressure, their profit margins fell far below their expectations.

In addition, dealers often were unable to obtain needed inventory. In January 1981 Apple, after closing for 2 weeks during the December holidays and drying up the production pipeline, announced a price increase and was unable to meet demand. Dealers withdrew quotes previously provided to prospective customers and were unable to fill orders. The scarcity lasted for almost 2 months and left a bad taste in many dealers' mouths.

The frustrated independent retailers were beginning to develop a love/hate relationship with Apple; while providing the great majority of their revenue, the company, they felt, was becoming overly autocratic. Their frustration only grew when they realized they had no alternative. Apple was the best machine on the market for the majority of applications, and demand was constantly growing. If IBM did enter the marketplace in a meaningful way, it could only hurt the retailers; IBM sold all devices directly to clients and never through third parties. Dealers also believed that, in entering the personal computer marketplace, IBM would be trading solely on its name, and that the huge bureaucracy would not be able to respond properly to this new type of computer competition.

Enter IBM

Suddenly IBM took the plunge, and while its entry was hardly unexpected, its manner took even the most knowledgeable IBM watchers by surprise. As Robert Sobel wrote in his fine work *IBM: Colossus In Transition*: "The corporation's approach . . . indicated a previously unappreciated flexibility at IBM headquarters and in the field."

IBM's approach represented dramatic changes in its corporate practices. The first surprise was that IBM would sell its personal computer, called the PC, through retail outlets, including its own retail chain of Product Centers, ComputerLand stores, Sears Roebuck Computer Stores (which would open throughout the country), and selected independent retailers.

IBM would also both recommend and market third-party software for the PC. The initial announcement mentioned the availability of *VisiCalc*, *EasyWriter*, the *Peachtree Accounting System*, and a computer game from Microsoft (a game announced by IBM?). It also announced that the operating system used would be one developed by Microsoft, which externally resembled CP/M. The language provided would be Microsoft BASIC, already a standard in the industry. This willingness to deal with third parties was unheard of from IBM, which had previously tried to deny their existence.

The final twist was that IBM would sell PCs to its employees at significant discounts, encourage them to author software, and pay them royalties if such software was accepted and published.

The PC was to have 16-bit addressability with an 8-bit "bus," which made it technically superior to the Apple II, though not as superior as it would have been if it had been a totally 16-bit machine and utilized the Motorola 68000 chip rather than the Intel 8088 chip. It was to be an open machine with expansion slots, and third-party hardware manufacturers would have an easy time developing the same type of expansion devices that had enhanced the Apple II. In short, the elements that had made Apple successful were not only emulated but refined. For example, the Apple II's operating system and ROM are proprietary, and manufacturers such as Franklin and Syscom that attempt to copy them find themselves in court defending themselves against charges from Apple. The only proprietary item in the PC is the BASIC ROM, which, while not copyable, has not prohibited manufacturers such as Compaq and Columbia from developing machines that are completely compatible with the PC. As a further benefit to the compatible manufacturers, Microsoft may be contracted to provide its operating system to run with their machines. Warren Winger, the chairman of the retail Compushops chain, was quoted in *The New York Times* as saying,

"It appears that IBM had a better understanding of why the Apple II was successful than had Apple."

How was IBM able to shift gears so dramatically? Had the walls of the bureaucracy tumbled? Hardly. IBM had simply

IBM's biggest error was in underestimating the demand for the PC.

taken one product and placed it outside of the bureaucracy. A group headed by IBM vice president Philip Estridge was set up as a separate business unit in Boca Raton, Florida for the express purpose of developing a personal computer and marketing it effectively. Speaking at the Rosen Research Microcomputer Forum in early 1982 in Palm Springs, California, Estridge dwelt on the effort that had gone into learning about the retail marketplace, which was different from any previous IBM experience. He publicly expressed thanks to ComputerLand and Sears for helping to guide IBM through its entry into these unfamiliar waters. It is obvious that this group had autonomy not usually found within IBM. While it would be stretching an analogy to compare the Boca Raton atmosphere to Steve Jobs' garage, both environments allowed development creativity not often found within large corporations.

IBM's biggest error was in underestimating the demand for the PC. It could have sold its entire first year's projected production within the company to its own employees. People initially demanded PCs either because they recognized the machine's potential or simply because it had IBM's name. Data processing managers in large corporations, who resisted an influx of Apples due to either lack of understanding or fear, jumped on the microcomputer bandwagon because they could now do business with the same company that supplied the 370 or Series I.

Soon they were demanding it for more tangible reasons, such as the availability of Lotus' 1-2-3 and other programs.

Now the software momentum turned. Firms that had once hastened to produce programs for the Apple II now scrambled to create software for the PC. This software development took two forms. Firms such as Sorcim with *SuperCalc*; Software Publishing, with the *pfs* series; Anidata, with the *Market Analyst*; BPI, with its *Accounting Series*; and Dow Jones, with the *Market Analyzer* converted programs already available for the Apple II. They often incorporated improvements into the PC version. Firms such as Lotus, with 1-2-3; Context, with *MBA*; and MDBS, with *KnowledgeMan* developed totally new products for the PC. It was obvious that the reign of Apple as number one was drawing to a close.

Publicly, Apple welcomed IBM to the marketplace, saying that IBM's entry would increase market demand (it did) and expressing confidence that Apple would remain number one (it didn't). Apple attempted to accelerate work on two 68000-based machines, internally code-named Lisa and Macintosh, which it believed would be technically superior to the IBM PC. It also finally accepted that although problems of the early IIs had long been corrected, the II was not going to supplant the II in the marketplace, and it began work on long-overdue improvements to the II. But these development projects took too long. According to Michelle Preston, technology analyst for L. F. Rothchild, Unterberg, Tobin, "Apple had gotten complacent and had not capitalized well enough on its position of front-runner. The time that it took for Apple's developments to come to fruition allowed IBM to establish its conventions as the industry standards."

Apple's major project, the Lisa, turned out to be a complete reversal of Apple's traditional development pattern. The machine was closed; all applications programs were developed by Apple itself. The result, introduced in January 1983,

represented a quantum leap in functional integration and user-friendliness. It resembles in many ways the famous Xerox Star System, on which it is admittedly based, and utilizes a mouse to control "windows" containing application programs. The Lisa embodied truly state-of-the-art technology. Apple proudly stated that "Lisa was not a hardware solution, it was rather a software solution." With the industry applauding its creativity, Apple expected to take the industry by storm in the Fortune 1000 marketplace and to whet the lower-priced market's appetite for the Macintosh. While many are waiting with whetted appetite for the Macintosh, Lisa has certainly not taken the industry by storm. There is no single reason for the failure of Lisa to overwhelm the marketplace, but a number of apparent factors bear consideration.

Apple misjudged the marketplace. The same middle and upper managers in Fortune 1000 firms who made the decision to purchase the highly successful Apple II were not the same individuals who would be making similar decisions about the Lisa. Instead, data processing managers and purchasing agents were taking a much more aggressive role in centralizing microcomputer decisions under their control. And the cost of the Lisa, while not excessive for the system configuration, was high enough (over \$10,000 with printer), to remove the decision-making authority from local management and place it in the hands of central data processing managers in many organizations. Whatever the impetus, the decision-making power was being absorbed by individuals who often had long-standing relationships with and confidence in IBM, and held no special affection for Apple.

The Lisa arrived too late. By the time it appeared, MS-DOS had become the industry standard and I-2-3 was the most talked about program. The Lisa was compatible with neither. While the Lisa's approach represented a quantum leap over previous microcomputer systems, some analysts feel that it can be a handicap to be

too far on the leading edge. Peter Norton, in a talk to the NYPC User Group, called it a virtue that "IBM announces no machine before its time." This observation is borne out by experience in retail stores that display both the Lisa and PC. Invariably there is a much larger crowd around Lisas than around PCs, yet the stores always sell more PCs than Lisas.

Another Role Reversal?

Apple, stung by its apparently changing fortunes, responded in a number of ways: Steve Wozniak, who had been on an extended leave of absence completing his undergraduate degree and producing rock and technology shows, was lured back into the fold to become the principal engineer for the Apple IIe and Apple III product lines. His presence improved morale and resulted in the planning of mouse input and windows for the IIe, and consideration of such things as portable and high end IIes. Furthermore, John Sculley left Pepsi-Cola to become president of Apple, and he rapidly made his presence felt. Sculley is credited with the decision to add MS-DOS compatibility to both the Lisa and Macintosh.

The cost of the Lisa was reduced and the software unbundled to allow the purchaser to buy all, some, or none of it. While this seems like an expedient compromise to the marketing slogan "Lisa is a software solution," Apple's rationale is that since Lisa is being opened to third-party authors, it is not fair to the purchaser to restrict the choice of solutions to those developed by Apple.

IBM, on the other hand, seems to some to be reverting to traditional IBM behavior, and it's making its independent dealers quite nervous. The PC has been reunited with the rest of the firm, and high and low end products have been added. The high-end products, the 3270 PC and the XT 370, interact with mainframes and will be sold only through the IBM sales force. The low-end product, the PCjr, was announced late, and is considered overpriced by many. It confuses independent

dealers that concentrate on business applications and don't know where to place it. There is also a rumor that IBM intends to put forth an IBM-developed operating system as an alternative to MS-DOS. Rumors like this one make dealers very nervous, because it means they must compete with the IBM Product Centers and sales force selling IBM products.

There have always been dealers that felt that IBM was using them to rapidly enter the marketplace and, once there, would attempt to take control of all its sales. The rumor that IBM might cast off Microsoft feeds this fear, as it could indicate that IBM was attempting to take complete charge of its own destiny. With fears like this abounding, pressure for congressional legislation to prohibit manufacturers from capriciously terminating dealerships and franchises is currently being applied. In a recent talk given to the New York Society of Security Analysts, Esther Dyson, editor and publisher of the widely read *RELease 1.0* newsletter, stated that there are certain phrases in this industry that "rank with the 'check is in the mail.'" Among them are . . . 'our national accounts program is merely to support our dealer network' . . . and 'we intend to keep the system open as long as possible' . . ." Statements like these are frightening to independent dealers.

If this perceived role reversal is truly in progress, does Apple have a chance of recovering the number one position from IBM? In all probability, no. IBM has moved well ahead and has much greater resources than Apple to expand its capability. IBM announced on December 8, 1983 that it expects to ship twice as many PCs in 1984 as were shipped in 1983. It should be remembered that no one has come to the zenith of the professional microcomputer marketplace without following the original Apple II formula. ■

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PC And Apple: How The Chips Stack Up

To you, software and performance may be the major differences between the Apple and the PC, but to the software developer, their individual hardware quirks can make them harder—or easier—to program.

Historians are fond of noting that the past is prologue to the present. This adage is just as true in computer technology: Today's computer advances are built on those of the past, just as future improvements will owe a debt to the machines of today. In many ways, extra development and the examples of predecessors have given IBM an edge when its Personal Computer is compared to the Apple IIe.

The internal differences between the two machines may go unnoticed by consumers, who are more interested in performance. But for software developer Alan Dziejma, president of Business Solutions, Inc., these differences are crucial. They usually translate into additional time and money spent programming the older Apple to support applications that the more advanced PC can breeze through.

Because it is one of the few software companies creating programs for both machines, Business Solutions has a chips-on-up perspective on the differences between the PC and the IIe. Founded in 1980, the company's most successful product is *The Incredible Jack*, an integrated software package for the Apple IIe that combines word processing, free-form calculations, and filing. The company announced its newest product, *Jack2*, at the COMDEX show in November, 1983. In January, the company began shipping the PC version of *Jack2*, which combines word processing with chart-making, database management, and a spreadsheet. An Apple version of *Jack2* is scheduled to be available this month.

In writing the software for both machines, the company's 15-person team, headed by Dziejma, Brian Macker, Frederick Tryster, and John Devine, was forced to analyze them and compare how they performed similar applications.

"The PC is more machine than the Apple, it's more computer, but there is sufficient computer on both sides of the fence for the user to do productive and useful work," says Dziejma. "From our point of view it requires more of our talent

to get the Apple user to the same point as the PC user."

Chip Differences

Like Athena's birth from Zeus, the higher-priced PC sprang full-blown from the head of IBM, which was able to avoid the mistakes of the pioneer Apple. The 16-bit PC was directed at the better-financed business market, which demanded, and could afford to pay for, the additional power and sophistication built into the machine. The PC, with its 16-bit architecture, runs faster than the 8-bit Apple. With 16 bits, the PC is also more comprehensive internally, says the Business Solutions team, so that fewer instructions have to be coded and software writing is simplified.

Originally meant for hobbyists, the Apple uses a Motorola 6502 chip. Its internal memory configuration has evolved from 16 to 64K and now has grown to 128K, which is considered its practical limit. Initially, the Apple was designed for a cassette recorder storage system rather than disk drives, and for a 40-column television set rather than a monitor. Although its later models became more sophisticated, Apple was forced to maintain compatibility with its earlier versions and thus had to find ways to combat its own early awkwardness. Apple changed over to disk drives and expanded the number of monitor columns by adding software to applications programs and through expansion cards.

Using a faster Intel 8088 chip, the PC supports disk drives by using special-purpose integrated circuits, eliminating the extra software writing needed for the Apple. The PC's internal memory can be easily expanded to 512K—large enough to accommodate almost any application.

The PC is also laid out in a straightforward manner compared with the Apple, whose memory is fragmented. To get that 128K, Apple uses various slices of memory ranging from ½ to 48K. If the PC's internal memory is like an uncut pie, the Apple is more like a pie plate with various

sized pieces on it. These pieces must be juggled for maximum efficiency. This fragmentation slows the Apple and requires additional programming.

Monitors

For the PC monitor, IBM chose an 80-column display with highlighting. The Apple IIe's lack of highlighting is a drawback, according to the team at Business Solutions. With highlighting, a user can see such printer functions as underlining and boldface on the PC screen, which brings the user closer to the software developer's goal of "what you see is what you get." The PC monitor also supports a 256-character set, while Apple's has only 128. "The Apple allows 98 to 99 percent of what you're after," says Dziejma, but the additional characters enable the PC to include such special characters as diacritical marks used in foreign languages, special mathematical notation, or proofreaders' marks.

Still, the team finds that the Apple monitor does have some advantages, particularly in the realm of graphics. Icons—pictorial representations of data files or functions—look better on the Apple monitor than on the PC's. Also, the team discovered that the right- and left-hand slant characters on the PC are asymmetrical, giving a slightly lopsided look to such symbols as the envelopes used in *Jack2* to represent data files. What appears as a neat, solid line on the Apple is translated into a broken line by the PC. Both machines allow the screen colors to be reversed, although the PC can't do underlining in this mode. Neither machine has trouble handling color graphics, but IBM software needs additional programming to handle that machine's required second color driver, which, the team says, is slower than the Apple's driver.

The PC monitor boasts an extra line, although its value is unclear. Some software developers use this extra line, but Business Solutions prefers the 24-line format that works on either monitor.

The most significant difference be-

tween the monitors is, of course, the number of columns. The PC started with the more useful 80 columns while Apple had to grow to that size from 40 columns. Nor was that growth without pain. Hackers were among the first to produce expansion boards that allowed the doubling of column space, a tricky process accomplished by creating a second 40-column block of memory and interleaving it with the original, a column at a time, to create 80 columns. Interleaving is like taking two halves of a deck of playing cards and shuffling them together. When Apple began producing its own expansion components, it had to follow the same pattern to maintain compatibility.

The interleaving creates an additional problem for software writers, who essentially face two 40-column banks, one of all the even-numbered columns and the other, all the odd-numbered ones. For example, in the 80-column Apple, the string A, B, C, D, E, F . . . is really A, C, E . . . filed in one bank, and B, D, F . . . written in the other. It's like writing the various letters alternately on two blank pieces of paper and then fitting the pages together so that a word can be read. On the screen, the user sees the correct alphabetical order because the two banks are meshed.

Keyboards and Storage

The average user most often will focus on keyboard differences, because this device is usually the most used part of the computer. Here the PC, with its 83 keys, has both advantages and disadvantages over the 63-key Apple board. Because of the extra keys, some functions are easier on the PC. The numeric keypad provides better cursor control, but the Business Solutions team described the NumLock key as cumbersome since a user will sometimes inadvertently type a number when all he really wanted to do was to move the cursor. The arrow keys also create some confusion.

In addition to internal memory configuration, how a machine uses its memory storage and retrieval systems is crucial.



Such functions as formatting and copying go more quickly on the Apple because the machine has less to do on its more limited diskette.

The 400K capacity of the PC diskettes gives the bigger machine an advantage over what is essentially 140K of usable space on the Apple diskette. From the consumer's viewpoint, the added space means more files on a single diskette. But the added space is also essential to an increasing number of applications; sophisticated business programs simply require the additional space, while such important marketing pluses as on-line help programs further eat up the memory. To use *Jack2* on the Apple, you need to boot the machine from one side of the diskette, then manually flip the diskette to run the program, says Dziejma. On the PC, the user just pops the diskette into the drive, and it is ready to run. Apple's limited space could also influence future enhancements, he continues. Because of the available space on the PC version, Business Solutions is considering adding such func-

tions as scheduling and telephone logs to its product. "But, I think we've gone about as far as we can go with *Jack2* on the Apple," he says.

Speed of application is a primary concern of consumers. Here the Apple not only holds its own, but ironically, because of its smaller disk capacity, it sometimes runs faster. Such functions as formatting and copying go more quickly on the Apple because the machine has less to do on its more limited diskette. For the same reason, the time it takes to boot the diskette is far shorter on the Apple than on the PC. However, the PC's assembler program is faster than the Apple's because of the machine's inherent speed. This extra speed translates into less of a wait for the machine to run the programs, an advantage to software developers. The PC's assembler is also more powerful, according to the team. On a pragmatic level, this greater power allows for faster debugging of PC programs.

Price

Even though the same software is often more expensive and more time-consuming to develop for the Apple than for the PC, the price of software for the PC is usually higher, says Dziejma. For example, *Jack2* for the PC, at a manufacturer's suggested retail price of \$495, is \$100 more expensive than the Apple version. That difference is chiefly due to the market. Because the Apple itself is cheaper than the PC, that price differential must be carried over to the software, says Dziejma.

By arriving in the marketplace later, IBM certainly gained an advantage, but more recent entries reap the same benefit from IBM's work that IBM got from Apple's. Time, tides, and technology wait for no one, not even Big Blue.

"For the future," says Dziejma, "it will be interesting to see how IBM retains compatibility with its installed base while extending the PC's functionality. How will IBM deal with the questions of improvement that Apple has had to answer?"

Student Aid From IBM And Apple

Competitive charity from IBM and Apple directed at the nation's schools is shaping the very educational market the two giants hope to serve.





Two key competitors in the educational computing market—Apple and IBM—are shaping computer pedagogy as much by their charitable contributions as by their general manufacturing and marketing practices. Both companies have long been active in devising educational applications for their hardware and have pioneered as well as followed the emerging trends in computer education. Apple Computer, Inc., for instance, has been associated with educational software since 1979, the year the Apple Educational Foundation began operation. IBM Corporation has patronized university-level classes for many years, particularly in engineering and other high-tech schools. The evolution of educational computing casts some light on the current involvement of these two major contenders for the educational market.

Until recently, the emphasis in educational computing was on the computer's ability to relieve teachers of drill and practice responsibilities. Early educational applications merely duplicated tried and true classroom methods. Teacher repetition was replaced with computerized repetition, particularly in the teaching of mathematics. The programs used straightforward question-and-answer formats in which incorrect responses triggered a lesson review.

Student access to the computer's more advanced features has been at the heart of the great computer literacy debate. Educators disagree about just how technical pre-college computer education should be: Is a rudimentary understanding of how computers work and the ability to make them work sufficient to prepare our students for the high-tech real world, or must students be able to actually write programs?

The argument for a more relaxed definition of computer literacy appears to be gaining ground, and a wide assortment of content-specific software, that is, software designed to teach lessons in such subjects as history or science, has become available for this type of application. Just the same, most schools with computer labs

continue to offer classes in programming, but more often than not as an elective.

The most recent development has been an increased emphasis on a resource that has always been present, though unfortu-

The act would make it profitable for the company to put an Apple computer in every high school in the country.

nately in the background, and one at least as powerful as the computer itself—the teacher.

It isn't difficult to understand why it has taken so long to recognize the value of the teacher in educational computing. The first priority, getting computers in the classrooms, has been slow going. In 1981, some 700,000 computer units were sold in the United States. Only 5 percent, or about 35,000 units, went to educational markets. During that same period, the average amount of available computer access time for students (not necessarily used) was 9 hours *per year*.

Now that computers have gained a slightly better foothold in the educational markets, partly as a result of the many donations made by manufacturers, the roles of the teacher as teacher and computer as tool are on their way to becoming more clearly defined. The two major computer manufacturers, IBM and Apple, are currently vying for teachers' attention by touting their recognition of the importance of the teacher in the effective application of classroom computers and by inviting teachers to participate in the development of curricula that use the computer.

Apples for the Teacher

The Apple Education Foundation, a funding agency that operates under the patronage of Apple Computer, Inc., has

made a series of grants to support the development of educational software (sometimes called courseware) totaling over \$1.5 million in cash and equipment. The extensive library of courseware that resulted from the foundation's magnanimity did much to establish Apple's image as a company strongly committed to education. Its reputation was further strengthened by the enormous amount of publicity it received at the time the ill-fated Technology Education Act was making its way through the 1982 Congress. Under the act, the tax laws governing charitable contributions would have been changed to make it profitable for the company to put an Apple computer in every high school in the country. But because Apple's offer to do so was tied to the legislation, the company's grand gesture became moot when the bill died in the Senate.

With its 1983 grant cycle, called "The Teachers Can't Wait," the foundation is making a deliberate effort to move away from courseware development by focusing its attention on teacher training and support. Through its system of grants proposals, the foundation is searching out projects that, building on the existing library, will experiment with more effective uses of the courseware.

The foundation's new director, Dr. Barbara Bowen, is emphasizing three major areas: (1) curriculum development using innovative applications of the micro, (2) systematic evaluation of the effectiveness of the new techniques, and (3) the development of model teacher training sites. According to Patti Barrus, associate to the director, "We're now looking at how more effectively and innovatively to use the microcomputer within the learning process. Through these grants, we try to set up model teacher training sites across the country that will be networked together and will have access to share ideas and resources and provide models of excellence that show how the microcomputer can really be a tool for learning in the classroom."

Of over 1,400 applications submitted

for the 1983 grant cycle, only 12 will be chosen for support. Each grant site will receive 30 Apple II's, 60 Apple disk drives, 30 Apple monitors, 4 dot matrix printers, 30 AppleLogo and 30 Apple Writer II programs, 4 Hayes Micromodem IIs, telecommunications software, and other "selected" software. According to Barrus, "We're in the process of negotiating with some other contributors for getting other software out to those sites." The targeting of this impressive array of free equipment at the teacher training sites should be very significant.

Apples for Kids

In yet another major effort called "The Kids Can't Wait," Apple offered a scaled-down version of its nationwide offer to the state of California. At about the same time that California Democrat Pete Stark introduced the Technology Education Act (also known as "the Apple bill") into the 1982 Congress, the California legislature, under the advocacy of Governor Jerry Brown, was working out the details of a similar bill that would raise the state's limit for charitable deductions and make it feasible for Apple to donate (and write off) a microcomputer to each school in California. The bill passed, and Apple went into action. Applications were sent to all qualifying schools stating that if the school wished to participate, a representative must first be designated and trained before the equipment would be sent. Between the months of June and September, Apple shipped out one Apple IIe, one monitor, one disk drive, and \$2,500 worth of software coupons to 9,300 schools, including five systems to each of the TEC (Teacher Education and Computer) Centers in the state.

The 15 state-funded TEC Centers serve as libraries of computer products that teachers can use to give software a trial run before making a purchase. The centers played an integral part in training the school representatives required by the terms of Apple's offer and, in some instances, helped to distribute the



materials. When 85 percent of the Apple dealerships in the state volunteered to participate, each school was able to have its representative trained on the equipment at the dealerships or at the TEC Centers before the equipment arrived. "It was very important that the computer not just lie on their doorstep," says Renee Olsen, spokesperson for Apple. In addition to the training, reps were also given advice on curriculum development and explanations of the available software.

"The Kids Can't Wait" program served in some respects as a trial run on the state level in the event the Apple bill passes (it is expected to appear again in the next Congress). One of the chief concerns of the bill's opponents was that the computers would be sent to schools and gather dust since no one would know how to use them. Since the last computer was shipped in September, it's still too early to determine what effect the donation has had on California schools. Whether or not the project succeeds and exactly how that success will be measured are two important issues. The fact that the importance of teacher preparation has been recognized and to some extent accommodated is a lasting accomplishment.

The recognition of the importance of teachers is probably most critical on the precollege level where a student's study habits and perceptions of education are first formed. Yet, Apple is also beginning to get involved in university-level education. Recently, Apple donated 50 Lisas to Brown University in Providence, Rhode Island, as the first step in assembling a state-wide network, though for the time being, they will be used in a campus-wide network. According to Apple's Renee Olsen, university-level projects might very well become the next wave of activity for Apple. "You'll begin to see a big change in the efforts Apple is putting toward the university market," she said. "The family of products that will be based on Lisa technology could be very significant to universities."

With that in mind, Apple's decision to

offer an MS-DOS add-on for the Lisa system has suggested to some observers that the company is about to face IBM in what could be a head-to-head battle for a piece

Apple and IBM are shaping computer pedagogy as much by their charitable contributions as by their manufacturing and marketing.

of the university market pie.

IBM, with its long history of involvement in university-level computer education, seems to be holding its own in the charitable donations department. This past summer, IBM announced the award of \$40-million worth of equipment to 20 engineering colleges across the country. In addition, a joint effort between DEC and IBM resulted in a grant of \$50 million in hardware and support services to MIT.

The purpose of these massive grants is not entirely altruistic. It's no secret that IBM hopes to benefit in a number of ways. Getting feedback on design and securing future sales from engineers accustomed to working on IBM equipment are just two of the possible returns.

Real-World Education

IBM has made its presence felt in pre-college education as well. Although Big Blue doesn't yet have an extensive library of educational software to offer teachers, this is no doubt a temporary situation—witness the proliferation of software following IBM's inspired decision to publish the technical information necessary to write programs for the PC. However, it is IBM's penetration of the business world that is causing, if not waves, then at least a few ripples in the world of educational computing.

Educators know that the best way to

prepare their students for the real world is to offer them the opportunity to work on real-world equipment. Vincent J. Cirello, director of computer instruction for the East Meadow Union Free School District in New York, is currently investigating the possibility of using IBM equipment in his district for exactly that reason.

"We are really concerned with getting our students, especially those on the high school level, exposed to various types of equipment," said Cirello. "We're interested in IBM because we want to introduce our students to a machine that's had such an impact on the market, one that they will likely see when they leave school and enter the job market."

Cirello's district, which includes five elementary schools, one junior/senior high school, and one high school, first got involved with educational computing about 4 years ago. They began with a selection of Commodore Pets. "At that time," said Cirello, "they were marketing a special 'buy two and get the third free' deal. We started using them for high-school programming classes in FORTRAN, COBOL, Pascal, and BASIC."

Last year, the director decided to expand the program to the elementary school level. "One of our goals," said Cirello, "in developing the elementary school curriculum was to teach problem solving, critical thinking, and analytical skills. With that in mind, we began to investigate software with different variations of LOGO and finally the hardware. We settled on Apple because we felt it would do the job in those areas. They have such a large amount of educational software."

At the present time, the district has an installed base of 175 Apples as well as the Commodores, a Digital minicomputer, and three different word processors. Aside from an IBM Displaywriter that is used administratively, no other IBM equipment is being used in the schools, an arrangement that might change very soon. "As we add on in the word processing lab, our first priority is to include IBM equip-

ment," according to Cirello.

Aside from business skills applications, Cirello is also interested in IBM's "Writing to Read" program, an innovative use of micros in which first-grade students learn to read by learning to write on PCs and typewriters. Developed by Dr. John Henry Martin under the auspices of IBM, the program combines the use of PCs, typewriters, tape recorders, and wordbooks to teach young children to write phonetically in an effort to simplify the numerous and often contradictory rules of English grammar until the children understand the relationship between the written and spoken word. The program has been very effective in raising the reading levels of first graders, in some instances as high as one year over their grade level—no mean feat when considering that most first graders are learning to read and write for the first time.

The "Writing to Read" program is indicative of a new approach in educational computing, one that encourages the development of creative applications of business-oriented software in an educational environment (using word processors, for instance, to teach reading and writing skills). Proper learning environments are, of course, best built by teachers, not by computer "experts."

To that end, IBM recently joined forces with ETS (Educational Testing Service) of Princeton, New Jersey—the administrators of the SATs—to establish an \$8 million model program that draws on teacher expertise to develop the PC as a classroom tool.

The project, which officially began in March 1983, revolves around 1,500 PCs donated by IBM to about 80 participating high schools in three states, California, New York, and Florida. The schools, which include both public and private facilities, were chosen by ETS to comprise a representative cross section of the American school population. In addition to donating the PCs, IBM also provided for extensive teacher-training sessions that took place over the summer months at four

teacher-training institutions in each of the three states. There, teacher representatives from participating schools were taught the rudiments of computer operations and, in

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some cases, were invited to take the machines home with them to practice on over the summer. Since there isn't a huge amount of educational software for the PC, teachers were encouraged to develop their own packages for lessons using existing software and tailoring them to fit in original ways.

Dr. Daniel Brovey, project director at the Queens College School of Education, Office of Microcomputer Use in New York, helped coordinate one of the four teacher-training institutions in that state. The Queens College site was one of the largest, with three teachers attending from each of the seven public and two private schools in the area.

Dr. Brovey is enthusiastic about the nature of the training sessions because participating teachers were required to compose their own lesson plans rather than simply learn how to plug in a program. "The intent of the grant was *not* to look at the programming aspect of computers," said Brovey, "and *not* to look at the content-specific software, but rather to examine the possibility of using computers as a general-purpose tool in all curriculum areas." As a result, teachers at the training institutions found themselves incorporating graphics packages, word processing, and even database management systems into their lesson plans.

Brovey believes that with this ap-

proach, computers have the potential to allow students to see the whole "ecology" of a particular field of study, that is, to see how all the various pieces fit together. He pointed out that it is up to the teacher to bring his or her expertise in the subject to bear through the computer. "This sort of teaching," said Brovey, "changes the relationship among teacher and student and a body of knowledge."

Brovey is pleased that the project was designed to be self-sufficient. The donation included a subscription to The Source network, thereby insuring that all the participating schools will be able to continue to share their findings and difficulties through that service's electronic mail feature. Brovey is most enthusiastic, however, about the level of teacher support, which began with the 4-week summer training sessions and which will continue, as needed, through the funds provided by the grant to each of the teacher-training institutions.

This foray into precollege programs is as atypical for IBM as Apple's entry into university-level education. The fact that these two computer giants have decided to pursue similar paths, as far as teacher support is concerned, bodes well for students and educators alike. It is possible that all this activity could finally put the educational computer in its proper place—as a tool whose use is determined by teachers, not computer experts. The tremendous storage capacity and lightning-quick search capabilities of the computer could allow for completely new and potentially effective teaching techniques that were simply not possible before its arrival in the classroom. As Dr. Brovey said, "We've taken the first crude steps in technology, all of us, and now we're ready to stand up and see what the ground looks like." ■

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From Apple To IBM And Back Again

The Apple-IBM Connection allows Apple users to transfer files to the PC, and vice versa; however, it only works on ASCII sequential files and requires certain hardware.

When IBM announced its Personal Computer more than 2 years ago, few would have expected its impact. At that time, the acknowledged leader of the microcomputer world was Apple Computer, followed closely by Radio Shack. But, thousands upon thousands of people jumped aboard IBM's bandwagon, leaving their Apples and TRS-80s behind, and quickly transforming IBM from the new kid on the block into the new leader of the micro market.

If you were one of those who made the switch, it was probably a traumatic undertaking. You were faced with not only changing machines, but also by the prospect of moving to a totally incompatible operating system, which made all your data disks obsolete. After all, you can't use an Apple or a TRS-80 formatted disk on an IBM PC, or vice versa.

There was, however, hope for the data disks, thanks to the one great leveler of microcomputer systems—ASCII. If data files could be changed into ASCII files, which then could be transferred to the PC by modem or null modem (crossover cable) then Apple files could be read on the PC.

But, this option immediately presented three problems for the PC converts. First,

Apple-IBM Connection

Alpha Software Corporation

30 B Street

Burlington, Massachusetts 01803

1-800-451-1018

List Price: \$250

Requirements: IBM PC and Apple II, II+, or IIe. For IBM; 96K RAM, one disk drive, I/O port. For Apple; 64K RAM, one disk drive, either an Apple Super Serial card, CCS 7710 card, D.C. Hayes Micromodem II card, or CPS card from Mountain Computer. Modem cable (for same-room connection); any acoustic modem or any Hayes modem (for over-the-phone connection).

CIRCLE 717 ON READER SERVICE CARD

you had to have access to your former machine. Second, you had to have communications software for both machines, and, third, you needed either a null modem cable (if the two were in the same room) or two modems and a good telephone line.

None of these problems are insur-

Alpha provides for
only one backup of
the program disk,
but will sell you a
replacement disk for
\$20.

mountable, but they do present enough headaches to make the chore of moving files from one system to another rather tedious. Alpha Software Corporation in Burlington, Massachusetts, has solved at least the communications problems involved in transferring files from an Apple to an IBM system with its *Apple-IBM Connection* software.

You will still need an Apple II, II+, or IIe, and a null modem cable or a pair of modems, but at least you won't have to worry about supplying two software packages. The *Apple-IBM Connection* does that for you. Actually, the *Apple-IBM Connection* is little more than a file transfer program, a function that many communications packages on the market can handle. Its key difference is that it is a complete, specific package for the Apple and IBM PC, which contains the program disks needed by the Apple and the IBM and the appropriate documentation.

The menu-driven *Apple-IBM Connection* is very easy to use. On the PC side, all you need is an asynchronous communications port, a minimum of 64K RAM, and a disk drive (96K RAM is better because you can run the faster compiled version rather than the slower BASIC version of the program). On the Apple side, you need

an Apple II, II+, IIe, or III; 64K RAM; an 80-column display board (either a CPS Multifunction Card from Mountain Computer, a CCS model 7710, Apple Super Serial Card, or a Hayes Micromodem II); a null modem cable; or two acoustic couplers.

You also need DOS 1.1 for the PC program disk. Although this program will run under DOS 2.0, the program disk itself is designed for DOS 1.1. Alpha emphasizes this point in the documentation. Since DOS 1.1 programs can work under a DOS 2.0 system, it is possible to use the program disk with 1.1 installed on it, even if your machine uses DOS 2.0. Therefore, you must have DOS 1.1 available to install on the disk.

The first thing you have to do is install the operating system onto the program disk. The Alpha disk supplies both a DOS routine to handle this function and a method of creating one backup copy of the IBM disk. You must similarly prepare the Apple disk for its side of the *Apple-IBM Connection* and create a backup. Alpha provides for only one backup of the program disk, but will sell you a replacement disk for \$20.

Alpha prefers that file transfers be handled directly from machine to machine using a null modem, but you can also do it with phone lines and modems, although this method is a lot slower. If the machines communicate directly, you can, with the latest program version, transfer files at speeds of up to 9600-baud, as opposed to the 300 to 1200-baud limitation imposed by modems and phone lines.

Once you have connected the machines, you use a Ctrl-Alt-Del boot to load the program into the PC or call AIBM-LINK from DOS.

After the usual sign-on screen, you are presented with a master menu, which gives you not only a choice of mode, but also of the type of link, baud rate, and error checking method.

Your mode choices include send, receive, send-compare, receive-compare, master, and slave. You use the send and

receive modes in conjunction with the master and slave modes, to send electronic mail. Send-compare and receive-compare are for transferring files from the Apple to the PC or vice versa and are also used in conjunction with the master and slave modes. The link could be a crossover cable, Hayes modem, or an acoustic coupler. Error checking is a CHECKSUM routine, which checks to make sure all the data bytes agree.

Transferring your Files

To transfer a file from the Apple to the IBM, you must establish communications between the machines, determine which system will be sending the file (master) and which receiving it (slave). You must also determine the type of link you will be using, the type of error checking (one mode offers echoing), and the baud rate. You can also opt for the default settings, and things will work quite nicely.

If you are transferring a file from the Apple to the IBM, then the Apple is the master and the PC is the slave. Once you make your choices, all you have to do is hit the escape key and the words Evaluating Communications Link will appear on the screen, followed by: Mode: Slave, State: Waiting. When the link between the machines is firmly established, the screen displays State: Link Established, and the program takes control. Everything is handled automatically by the Apple side of the connection.

As you are sitting in front of your PC, you will notice some things happening. First, Drive A will activate under the program's control, which indicates that the information from the Apple is being stored as a data file. At the same time, the screen prompt changes and indicates how many Sterzag units have been moved. (Sterzag is a name the company used during program development to indicate the amount of data moved. It is equivalent to a data block 127-bytes long.)

When transferring the file, you are using the send-compare mode from the Apple and the receive-compare on the PC.

Incompatible Apples

Compatibility among its own machines has been the specter haunting Apple for the past several years.

If you think you have problems moving a file from an Apple computer to an IBM Personal Computer, think about the problems Apple users have moving files from one Apple machine to another. Twice in the last 5 years or so, Apple Computer, of Cupertino, California has come out with machines that aren't compatible with earlier models.

When Apple introduced its successful II and II+ series, it had a winner on its hands. It became the leading seller in the microcomputer market and a huge industry developed with it, marketing add-on hardware and software. Like the IBM PC, the Apple was an open system and designers were free to create add-on boards that increased the functions and flexibility to the system. Third parties wrote software in huge quantities for the Apple.

With this track record, you would have expected any new Apples to have been compatible with the successful II and II+. But, for some unknown reason, Apple's business-oriented III was essentially incompatible with the II. Granted, its new Apple SOS (Sophisticated Operating System) would operate in a mode that emulated the II's system, but the III was very slow in this mode, and this drawback hardly encouraged II users to upgrade to the new machine, especially if they had a great deal invested in Apple software.

Although sales of the III were good, they still couldn't compare with the II series and by 1982, well after Apple finally decided it needed an upgrade, it was time for a new machine. So, Apple did what was logical and brought out the IIe, an upgraded, totally compatible version of the venerable II and II+ series. Although the III's hardware was serious-

ly different in some areas, its operating system was essentially the same, and anyone contemplating the change to the new machine from an older model could at least be confident that the software base wasn't obsolete. Apple has recently announced that it will be making the III totally compatible with the IIe.

Shortly thereafter, Apple brought out its highly priced, highly touted Lisa system, based on the powerful MC-68000 processor, but it, too, was incompatible with any previous Apple software. Yes, it had a wonderful, but slow, set of totally integrated programs, but an Apple user, contemplating an upgrade to the Lisa, would find the software base incompatible with the new system. Industry analysts recently have speculated that most established Apple users will think twice about making the switch. This problem might be hindering Lisa's sales.

In response to this problem, Apple is likely coming out with a scaled-down version of Lisa, called Macintosh, to help build a user and software base for Lisa. Apple has also announced a communications package that will enable Apple users to port their data files over to Lisa. (This package has been promised for some time and was announced when Lisa was introduced.)

Another factor limiting Lisa's acceptance is its total incompatibility with the IBM Personal Computer, the standard of the corporate world. Analysts have noted that such is the acceptance of the PC as a standard that many Fortune 500 companies haven't considered the Lisa as an alternative. Apple has noted this problem also; Apple's president, John Sculley, has promised an "MS-DOS window" in the first quarter. —A.H.

File Transfer Alternative

The Apple-IBM: File Transfer Program is slower than the Apple-IBM Connection and works only if the two computers are in the same room.

The *Apple-IBM Connection* isn't the only Apple-to-IBM PC file transfer program on the market; another is *Apple-IBM: File Transfer Program* from Personal Computer Products, of Santa Clara, California. It's a simple file transfer program and makes no bones about telling you that, up front.

"This program is a file transfer program. It is not a full blown communications program. It is not a conversion program. This program will assist you in converting programs to the IBM but there is no automatic procedure to guarantee that *you* can convert it. Some programs are more easily converted than others—some are almost impossible," states its brief documentation.

Indeed, if you are working with a straight ASCII file, you will have little problem moving it from the Apple to the IBM PC. All you need is a serial port on both sides and the special connector that is included with the package. This connector plugs into the serial port of the IBM and allows you to run a cable directly from the Apple to the PC.

Remember, since it isn't a communications program (although it can be used in conjunction with a communications/terminal program), but a file transfer program, it lacks the ability to create any sort of remote terminal configuration on both sides, so both computers have to be in the same room. The arrangement is ideal when you have many Apples and IBM PCs. It may be less efficient for a single user.

If you have access to both machines, then using this program is relatively easy. You need an Apple with Apple

DOS 3.3 and a disk drive (as well as the serial port) and a PC with DOS 1.1 or 2.0 and a disk drive. The program material comes on a floppy diskette, with one side containing the Apple material and the other containing the PC material.

Since this is an Apple-to-PC transfer program, the test file (which is sent first

A program within the Apple-IBM: File Transfer removes all null characters and control codes that the PC may not recognize or that might send the PC off into some computing Never Never Land.

to test the linkup between the Apple and the PC), is the first file on the Apple side of the link that is used. The PC merely acts as a slave unit to the Apple, until after all the material is moved from one machine to the other. Both serial ports must be set to exactly the same parameters: 300-baud, 8-bit word, no parity, and two stop bits. As you can see, this program unfortunately doesn't take maximum advantage of the high data transfer speeds (up to 9600-baud) under a machine-to-machine hookup.

At first, you may receive a Device I/O Error message when you try accessing the PC. However, this message should occur only once, and afterwards everything should move forward quickly, with little trouble.

The test file transfer points out a key element in the transfer problem, the way files are stored on disk. The Apple and the PC use different methods of storing random data on a disk. In order to make the Apple file compatible with the PC, all the data is left justified and padded on the right with spaces to reach PC record length size. Further, you must use a program, included on the PC side of the disk, called CRLFADD.EXE. This program removes null characters and control codes that the PC may not recognize or that might send the PC off into some computing Never Never Land.

The program's developers urge you to compress an Apple file's data if there is a problem with it. That problem is usually a null record in the middle of the file, which the file transfer program can't read past. This maneuver should help straighten out the problem.

To help eliminate problems with codes the PC may or may not recognize, the program suppresses certain control codes. If it sees a Ctrl-D (ASCII 4), which is a hook into Apple DOS, the program won't allow it to be sent. Likewise, the high-bit (ASCII 128+4) Ctrl-D isn't sent.

Also Ctrl-Z (ASCII 26), which the PC sees as end-of-file, and the high-bit Ctrl-Z are stripped and suppressed in the Apple file. This means you can fully access the Apple files with an editor.

Basically, the PC disk contains five compiles files. In addition to CRLFADD.EXE and HICLEAN.EXE, it has a BASCLEAN.EXE utility to clean up any high-bit control characters in a BASIC program file, and an APLT-BIBM.EXE file, which allows you a bigger program file transfer buffer. This file is used with a PC having more than 96K RAM.

Overall, the *Apple-IBM: File Transfer Program* is simple. It will handle BASIC file transfers, Pascal program transfers and ASCII file transfers (which are much easier all around since ASCII text files are stored sequentially). It will also handle *VisiCalc* when the file is converted to a .DIF file with the conversion utility.

"This program won't transfer assembly language files. If you are purchasing this program to convert all your assembly language game (or other assembly language) programs to the IBM PC—forget it." According to the manual, assembly language programs are nearly impossible to convert.

The documentation itself is only about 10 pages long and is quite readable. It presents not only information about the program, but also the theory behind it. It also gives you some tips about handling file transfers and conversions (for instance, Apple PEEKS and POKES can't be used by the PC because the memory structure is different).

If you are in the market for an Apple-PC transfer program and have access to an Apple which can be directly tied to the PC, then you might want to consider this \$129.95 package.

—A.H.

The situation is reversed if you are moving a file from the PC to the Apple. These modes allow you to compare the file you have just received with the file that was sent.

Equally easy is using the send and receive modes to transfer electronic mail, which can be done once you have put the machines into master and slave modes. However, you must use a line editor such as *EDLIN* or a text editor such as *WordStar* to create the electronic mail messages you are transferring.

The *Apple-IBM Connection* is totally menu-driven. The menus are self-explanatory, so a new user should have little trouble handling the program the first time around. In fact, the program only allows the user to interact with it at the start and at the end. The machines themselves handle everything else.

When I was transferring some test files at 300-baud over a telephone hookup, the message "X Sterzag Units Transferred" appeared. Since the file transferred was short, the whole process was very quick, but if the file were much longer, it would have been much more efficient to use a null modem cable.

Bugs

Although this program is easy-to-use, its total reliance on system control does have a drawback. As I was attempting to transfer a second file, the message—Fatal Error, Attempting To Reestablish Link—appeared. The attempt failed. During this time, I could not use the keyboard because the program was in control, so I had to reboot and restart it. Fortunately, my modem managed to hold the other carrier, but every time I attempted to restart the program and receive the file, my PC kept unsuccessfully trying to reestablish the link. At times like this, a little operator manipulation might be helpful. The user could try to force a send state and reestablish the link manually. Alpha should consider this addition.

While my system was trying to reestab-

lish the link, I was particularly disconcerted by the cryptic message, Fatal Error. It made no mention of what the error might be or how to get my system out of the loop it was apparently in.

Despite this problem, the program appears largely crash-proof. The program's built-in error-checking routine facilitates error handling. And since you can't get in, you can't cause the system to crash unless you consciously push F1 and then X to exit.

Only ASCII allowed

It is important to note that the program accepts only sequential ASCII file transfers. (It shouldn't be any real problem with ASCII text files since they are usually stored sequentially. But any other random files on the disk must be made sequential. You will probably need a separate utility program to determine if your files are random or sequential and another to make them sequential.) Binary files won't work, as Alpha states clearly in its documentation. Any file, whether text or BASIC, must be in an acceptable ASCII format. And, while this requirement is good in most business or personal settings, in engineering, scientific, or industrial environments, where binary information is primarily used, it might not work as well.

Interestingly, it is possible to transfer some machine language program files with the *Apple-IBM Connection*, but you must first convert them to BASIC and then save them as ASCII files.

Despite the ASCII standard, some system incompatibility must still be overcome. When the PC creates a DOS text file (ASCII) the system requires each line to have a hard carriage return and a line feed at the end. However, Apple uses only a carriage return, without a line feed. If you were to attempt to transfer a straight Apple-created ASCII file, the PC would receive it as one long line. Therefore, you must use a filter program to add the line feeds the PC needs. This program is included on the disk that Alpha supplies

for the PC as part of the Reform utility and is written in BASIC.

Conversely, to send a text file from the PC to the Apple, you must use this program to remove the line feeds and leave only carriage returns. It's not all that difficult to do, but it does add a layer of potential complication if you forget to use the utility.

Interestingly enough, this program can send Apple-created *WordStar* files to the PC and vice versa. Likewise, *VisiCalc* files can also be transferred, if they are converted into .DIF (Data Interchange) files. To perform these file manipulations, you must first receive the files from the Apple and then run them through the Reform utility. With this utility, a *VisiCalc* file will receive the correct .VC extension, while a *WordStar* file will create a .WST extension. On the Apple side, the file will appear without a filename extension for *VisiCalc* and as a .TXT file, if it was created under *Wordstar*.

Unfortunately, the more operations performed on a file, the greater the chance a data error will occur. But, you really have no way around this when trying to move from the Apple to the IBM PC and vice versa. (It is also possible to translate 1-2-3 or *Multiplan* files, but you must use a Lotus utility called *Translat* or *Multiplan's* Transfer utility and then the *Apple-IBM Connection* Reform command. It still means you have to do several manipulations to move one file.)

The *Apple-IBM Connection* further assumes that the Apple may have access to CP/M, so it includes a utility that converts CP/M to DOS, allowing you to create Apple DOS 3.3 files from CP/M files. You must perform the same type of manipulations as those for PC files. However, to use this program, you must also have the Apple CP/M card.

Warnings

Throughout the documentation, Alpha makes it clear this program is only for ASCII file transfer and nothing else. This warning should quickly end any notion

that an Apple user will be able to move all files over, including programs. The documentation also points out that Apple machine-language programs are machine-specific and won't run on a PC.

The factor that limits the use of this program is the few modems or cards it

The Apple-IBM Connection can't hold an interactive conversation with a user.

supports, especially on the Apple side. The *Apple-IBM Connection* can only work with Hayes Smartmodem series or Hayes Micromodem or acoustic couplers for the Apple and supports only Hayes products or acoustic couplers for the PC. Computer users without access to these modem products can't use the program.

Also, on the Apple side, the program will only support a few serial cards in specific card slots on the Apple's motherboard, although it will support any PC-compatible asynchronous port.

Another limiting factor is the program's lack of a terminal mode. The *Apple-IBM Connection* can't hold an interactive conversation with the user at the other end, which can be especially aggravating if you are using a remote hookup and have to talk with the other operator. A simple terminal mode should have been included in this package.

The omission forces you to use a text editor separately if you are creating an electronic mail file for transmission to another system. You must exit the program, start the text editor (or EDLIN under DOS) write the message, manipulate it through the Reform utility and then send it. With a terminal mode built in, messages could be sent in real time, rather than on a delayed basis.

On the Apple side, a Message utility

allows you to create electronic mail messages, but you still have to exit the program, call up the utility, write the message, call up the program, and send it.

Documentation

On the whole, the documentation for the *Apple-IBM Connection* is very well done. Written in a highly readable style, it addresses both the new computer user and the experienced veteran.

It tells you more than you'll probably ever want to know about filename structure, extensions, and how to manipulate those files. The *Apple-IBM Connection* manual is also probably the only one on the market that clearly explains what a crossover cable is and how it's used. The manual, which comes in an IBM-style three-ring binder, has an interesting twist. To help someone get into the program quickly, it includes a short taped tutorial that presents the program in broad strokes.

Alpha Software's support policies seem good, too. When I had to ask a few questions, Alpha put me right in touch with the correct person and everything was handled efficiently.

The *Apple-IBM Connection* is potentially a valuable tool in business, where many Apples and IBM Personal Computers may have to share data files. Further, if an Apple user at home must communicate directly with a PC in an office setting, this program is also a good investment.

For single users, though, its use is likely to be limited unless they plan to keep their Apple computers when moving to the PC. For a one-shot migration of data files from the Apple to the PC and then for use as a communications program, users will find the program somewhat limiting. If you fit this category you would likely be better off using a general communications/file transfer/terminal package. ■

Alex Holmes is a Boston-based computer consultant who writes frequently for publications in the consumer electronics field.

The Apple Of Your IBM

The Quadlink, an Apple-on-a-circuit card that fits snugly into your PC, converting it into an adaptable two-in-one microcomputer that can read software for either machine.

If the PC has any rival, it's the Apple IIe, a machine that's found a happy home in as many places as our favorite box from Boca Raton. Although for sheer computing power, the Apple pales beside the PC, it does have one great virtue: More business and educational software may be available for it than for any other personal computer.

The power edge of the PC makes most

Quadlink

Quadram Corporation
4355 International Blvd.
Norcross, GA 30093
(404) 923-6666

List Price: \$680 (\$695 for Columbia or Compaq, \$45 cables only for Columbia and Compaq).

CIRCLE 716 ON READER SERVICE CARD



worries about software advantages moot, except for a single point: The Apple came first, and many businesses have them already installed and have countless hours and keystrokes invested in its software. Besides, once people have become comfortable using one computer, getting them to switch is about as easy as convincing them a trip to the dentist will be fun. Thousands of businessmen have their fingers welded to Apple keyboards.

If only the PC could run Apple software, the world would be a better place. Your PC would have more than double its present program supply, businessmen could dance their fingers across a more advanced computer and keyboard, and that huge investment in programs and keystrokes now stuck on Apple disks would be fodder for your PC. All you would have

to do is take your favorite Apple program, slide it in your PC's drive slot, and calculate away.

But one major mountain blocks the way to such true bliss: incompatibility. If you do put an Apple disk in your PC, you'll find it as good as no disk at all. The IBM PC cannot read Apple disks, and it cannot run Apple programs.

Genius is hardly required to deduce that what the world needs now is some way of squeezing Apple programs into the PC or vice versa. Of course, the first seems more likely than the second. It's probably much easier to detune a race car to amble around in the daisies than it is to turbocharge a Volkswagen beetle and make it zoom away from traffic lights.

The Quadram Corporation was able to see behind the barriers and has created exactly what the doctor, and anyone who happens to work with both an Apple and an IBM PC ordered: The Quadlink, a compact card that drops into your PC and, with a little help from the software, turns it into an ordinary Apple II.

A Look at the Quadlink

The Quadlink itself bulges with computing power. In fact, it has so much power it has to be spread out on a circuit board slightly larger than a full-sized PC expansion card. Every place extra circuit board real estate could be found, Quadram tacked on more glass-epoxy. The Quadlink board rises a fraction of an inch higher than normal expansion boards, though not enough to interfere with putting the lid on your PC. The card dips down next to the edge connector that actually makes contact with the expansion slot and closely follows the contours of the PC motherboard. It fits as much circuitry as possible on a single, one-layer board.

All the extra area is necessary because the Quadlink is no mere expansion card. It's a complete computer that, once installed, nestles happily inside your PC. On board is a 6502 microprocessor and all the necessary support circuitry, including a full 64K of read/write memory. In

effect, a whole Apple II has been squeezed onto the single card, in roughly half the space the original takes up.

Because the Quadlink sports all the circuitry of a complete Apple computer, it also seems to generate as much heat as a



The first evaluation board that I received from Quadram refused to work with my composite monitor.

complete computer. I noticed that the integrated circuit chips on the Quadlink card that felt the hottest were all mounted in sockets while the cooler chips were soldered down.

Overall, however, workmanship and design of the Quadlink appear to be very good. With that said, note that the first evaluation board that I received from Quadram refused to work with my composite monitor. While talking with an engineer at Quadram about the problem, my eyes wandered over the circuit card, and I noticed that a resistor had not been

properly soldered onto the board. The day after I had called, I received a replacement Quadlink that worked without a hitch.

Installing the Quadlink

Perhaps the most notable aspect of the circuit card is its profusion of connectors. The Quadlink does not slide into an expansion slot; it slithers, spreading out its octopuslike arms to connect to almost every part of your PC. The Quadlink intercepts the output of the PC disk drive controller and sends its own signals to your disk drives. It intercepts your PC's speaker output and sends its own signals to your ears. The Quadlink even comes with a short video cable that connects to the output of your resident video card (monochrome or color graphics), which connects on the outside of your PC.

Making all of these connections correctly proved to be the most troublesome aspect of installing the Quadlink. Quadram rightly advises totally dismembering your PC before putting the ungainly Quadlink in place. Every card should be cleaned out of your PC's expansion slots before you begin installation.

The octopus nature of the Quadlink also dictates which slot it must fill. Since it must attach to the ribbon cable running to your disk drives, it must be as close as possible to the drives. This means the slot adjacent to the drive controller (slot number four, if you count like IBM does).

The first challenge of the installation is weaving the cable that goes to the drives around the other wires that connect to them, and then down onto the floor of the PC cabinet (so that the drive controller card could still be fitted inside the computer). There seemed no way to get the writhing, uncooperative cable to lie flat, short of creasing it several times in the center and folding it over. As it was, even after wallpapering the bottom of my PC with the disfigured cable as well as my tangled fingers could, the wiring still bunched up between the Quadlink and drive controller card (once the latter was installed). This cabling catastrophe meant that neither

board was able to properly fit into its slot.

But the biggest problem I had with these ribbon cables turned out to be a bit of short-sightedness in the design of the Quadlink's umbilicals. The cable to the disk drives is keyed to fit on a card edge connector only one way. This is a wise design that prevents your computer's circuitry from smoking should the connector be installed 180 degrees away from the optimum position, but it meant my disk drive cable had to be installed so that the ribbon cable leads away from the Quadlink card in the wrong direction (away from the disk drives). The result is that the drive cable must be folded over one more time directly under the Quadlink board, which shortens the cable's effective length and adds to the cable build-up in the bottom of the PC.

The drive cable is not the only one to suffer from misdirection. In addition a cable must be run from the Quadlink to the drive control card. The connector on the drive control end of the cable also sends the wire straggling 180 degrees off from the desired direction and requires another fold job. Cable installation for the Quadlink seemed more like origami than electronics.

The next wire I installed was to the speaker. A simple chore; just unplug the speaker from its PC-based connector and reinstall the wire to the connector on the Quadlink card. Then run a wire from the PC connector back to the card. With that done, it's safe to begin stuffing the PC back full of all the goodies that were inside in the first place.

Once you've got everything glued or screwed down, you connect the Quadlink to your PC's RGB or monochrome video output and plug your monitor into the Quadlink card. Total installation time was less than a half hour. (It's easier to do than to explain.) Nonetheless installation is not a process that anyone would like to make a daily routine.

Next step in getting the Quadlink up and running is software installation. Two disks are supplied with the Quadlink: one

in IBM disk format containing the program that boots the Quadlink system, and one in Apple disk format containing all the necessary Apple-compatible software, including Apple's own DOS 3.3.

At this point, the manual and reality are somewhat at variance. According to the manual, merely copying the Quadlink disk onto a normal IBM PC system disk and using the result as a boot disk will start up

Put an Apple disk in
while in the PC
mode, and your
computer will think
that there's nothing
there.

your PC with the Quadlink raring to go. My Quadlink however, was not so eager, probably because Quadram neglected to put an AUTOEXEC.BAT file on the first Quadlink disk I received.

The disk I received with the replacement Quadlink circuit board, however, had the necessary AUTOEXEC.BAT file already in place, ready to roll.

Starting It Up

If you buy a Quadlink and it does not automatically start as advertised, creating such a file should make it work as promised. The necessary file contains exactly one word (Quadlink), and a carriage return. You probably use your word processor to create the file, or you can type in the word "Quadlink" in response to an "A>" prompt, and you will be on your way to the electronic Big Apple.

Once you've run the Quadlink program, it's time to follow the directions on the screen. Remove the Quadlink disk and insert the other disk supplied by Quadram, called the Filer. Press AH-Ctrl-A on your keyboard, and you enter what Quadram calls the "pre-Quadlink" mode. The screen reverses (dark becomes light, and

light, dark), you're advised to press Ctrl-Alt-Del and voila!—your PC has turned into an Apple. To return to the realm of the PC, press Ctrl-Alt-I. You can bounce back and forth as often as you like.

The first thing you'll see in Apple mode is a menu that appears on the screen with a list of the utility programs supplied on the Filer disk. One of the menu choices is the Filer itself, which offers a collection of utilities including Catalog (the Apple version of the disk directory). Others include file copying, deleting, write-protecting and un-write-protecting procedures, disk and DOS copying utilities, and a program for changing the logged disk drive. Typing Esc puts you into Applesoft BASIC, where, if you've been running Apples all your life, you'll feel right at home.

If you've never touched an Apple before because you have bad memories of Eden, Applesoft amounts to a combination of both BASIC and DOS, chopped into fine pieces and stirred together. Confirmed IBM PC users may feel as if they're caught in the twilight zone.

Finding myself in a confusing land where every DOS command I typed led inevitably to a syntax error, I asked my friendly neighborhood Apple expert, Frank Bican (a microbiologist by day and a programmer by night), to drop in and give the Quadlink a spin. We worked together, and in no time at all made mincemeat of half-a-dozen programs.

The Two for One Sale

According to the manual, the Quadlink board turns your PC into a new computer also called the "Quadlink." Actually, the board turns your PC into two computers—a PC and an Apple. The two computers function independently. You can have one program running on one while a completely different program is running on the other. Your two programs won't necessarily run simultaneously, however. What happens depends on the direction in which you shift modes. When you flip from the Apple to the PC, the Apple doesn't stop

dead in its tracks, but it keeps on dashing through whatever program you've stuffed into its memory, unless it requires input/output processing. When you flip from the PC to the Apple, however, the PC program is put on hold; when you flip back, you're at exactly the same spot as before.

Although both the description and process seem confusing, the explanation is not. No matter what the mode, your original PC is used for all input/output processing. This means it handles the disk drives, the keyboard, the printer, and so forth, no matter whether you're in Apple or PC mode. When the Quadlink/Apple takes command, the PC is put to work helping it out. Consequently, the PC must put its own data processing on hold. The Quadlink/Apple, on the other hand, doesn't have anything to do when the IBM is running, so it can continue processing data. The Apple part only jams up with an I/O error if the program that is running on it tries to access a disk, the printer, or the keyboard while you're using that part of the PC. In technical terms, the Quadlink's 6502 microprocessor uses the PC's 8088 for I/O processing.

The separation between computers is both complete and effective. When you are in PC mode, a reset—pressing the infamous Ctrl-Alt-Del—only resets the PC. It does not touch the Apple-cum-Quadlink computer. In Apple mode, the same key combination resets the Apple without affecting the PC. I can't help but salute the engineer who done think that one up.

Even the disk drives shift between modes. In Apple mode, both drives think they're attached to an Apple. In PC mode, they function as IBM drives. Put an Apple disk in while in the PC mode, and your computer will think that there's nothing there.

No matter what you may actually have for your PC, the Quadlink can only handle two disk drives. I have a non-IBM hard disk drive that worked flawlessly when the Quadlink was in the PC mode, but became

invisible during Apple emulation. Similarly, virtual disks and RAM disks work normally in IBM mode but cannot be used by the Apple part of the Quadlink. (Data in virtual drives stays intact when shifting back and forth between modes.)

With the Quadlink running, the division between the two computers inside

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your PC's case is complete. Normally they do not share their thoughts with each other. Except for an intriguing comment in the manual that you can transfer text files between IBM and Apple disks, Quadram gives you no hint about how to make these two independent computers talk to each other. The Apple has no idea of what the PC is doing, and the PC hasn't the foggiest notion of what's going on in slot 4. A quick consultation with Quadram revealed that it is possible to get the two to communicate, but you need the proper software.

Although still undocumented at the time I received my sample Quadlink, the necessary program is included on the Quadlink Filer disk (providing the disk is dated 10-31-83, or thereafter). An earlier date (or none at all) indicates that you do not have this valuable program. Quadram will supply it free for the asking to early-model Quadlink owners.

The program is called *Quadcopy* and can be run either by selecting it from the appropriate menu or by typing `Brun Quadcopy` at the Applesoft prompt, which is a closing square bracket (`)`. The program is

self-documenting, which means that if you have a modicum of intelligence, you can probably figure it out.

However, shifting text files around runs afoul of another compatibility problem that has nothing to do with the Quadlink: Word processors use different methods of storing characters. I managed to transfer an IBM *WordStar* text file to an Apple file, but reading it through Applesoft BASIC only revealed gibberish. I was able to transfer an Apple text file to a PC file and read it through *WordStar* without a hitch.

When Frank and I attempted to run *Quadcopy*, we discovered an undocumented feature of the Quadlink. The PC's cursor control pad does not work in Apple mode, yet the first menu presented in Apple mode advises that you use the arrow keys to make your selection from the offerings (which include *Quadcopy*). If, when the PC's cursor keys do not control the cursor, your first reaction is like mine—to punch down the NumLock key—you'll discover that in the Apple mode, pressing NumLock moves the cursor forward and pressing the backspace moves the cursor backwards.

This limited cursor control is no great problem when picking a favorite from a menu, but one of the first programs my friend Frank decided to try was his global program editor. The two-key control makes using a global editor about as enjoyable for the fingers as a walking tour of the entire planet earth would be for your feet.

Dedicated PC users not privy to the secrets of the Apple will make another unwanted discovery. In Apple mode, there is no lowercase. The only way to pry lower case from the Quadlink's character ROM chip seems to be with a `CHRS` command. If you try this, you'll find that there are indeed lowercase characters locked inside the Quadlink and, compared to Apple's characters, they look good. They even sport true descenders, a feature Apple believes is unnecessary.

Frank toted along with him a tower of his favorite Apple program disks, and we

were amazed that the overwhelming majority of them ran without a problem. There were even a few surprises. Frank made calls to the Apple monitor, which, on the Apple, peeks inside the Apple's ROM. They worked fine on the Quadlink. Frank has written a large number of programs he uses on his Apple at work, and every one of his compiled and interpreted Applesoft programs ran on the Quadlink flawlessly. He did note that an interpreted program that runs on his Apple II+ in 40 seconds took a full minute on the Quadlink, but the same program compiled runs in 7 seconds on either machine. The Quadlink was happy to display Apple graphics and even played Apple music through the IBM PC speaker. It worked and played just like a real Apple computer does.

Not All Apples

Quadram claims that the Quadlink/PC combination will run a wide variety of Apple programs, but not every Apple program. Any program that requires a special peripheral, such as a special Apple expansion card, will not run on the Quadlink. There's simply no place to plug in the peripheral. Currently, the Quadlink will not run Apple programs requiring an 80-column text display, but Quadram is working on the necessary software.

Quadram says the Quadlink will run UCSD p-System programs for the Apple on one condition: Your PC must have two disk drives. On Apple computers, the p-System always looks for a second drive. If it doesn't find one on a real Apple system, the search just "times out," and the program starts running. This doesn't happen with the Quadlink, so the programs just hang up indefinitely. Frank tried disks zero and three of his Apple Pascal Compiler Version 1.1 and was not successful. These disks are for a single-drive Apple system, but will work on a two drive system if the second drive is not ready. In other words, our results confirmed Quadram's claims.

According to Quadram, copy-protected programs cause Quadlink's biggest prob-

lem. Many Apple programs are copy-protected by half-tracking (the protected program causes the disk drive read/write head to skate across the disk half-a-track at a time). In essence, part of the program is written in between the normal tracks. The process works fine with Apple disk drives, but the read/write head of the PC drives are so big that half-tracking is impossible.

No amount of coaxing could elicit hues other than black and white from the composite output of the Quadlink.

So half-tracked programs cannot be used. According to Quadram, some programs published by Broderbund Software, Sirius, Budge Company, and Stoneware (in particular *DB Master*) are copy-protected by half-tracking and will not run on the Quadlink/PC system. We tried Broderbund's *Serpentine* and confirmed that it would not run. We got as far as the opening display and then the Quadlink jammed up and required a reset to do anything else.

The PC side of the Quadlink's two modes has a compatibility problem, because the Quadlink is quite hardware specific to the IBM PC. A PC-clone is not an IBM PC, so don't expect the *Quadlink* to run on your non-IBM computer, unless you happen to own either a Compaq or a Columbia. The Quadram factory has tried out both of these PC-clones and found that they worked successfully. However, each one requires special cables, which are available separately or in conjunction with the Quadlink board. Further, the Quadlink will not operate the Compaq's internal monitor, although it will operate an external monitor.

Even inside a real IBM PC, the Quad-

link has some particular needs. Specifically, the manual advises that the Quadlink is only guaranteed to operate properly with genuine IBM or Quadram expansion boards. However, my PC is stuffed with extra memory and a color/graphics adapter, neither of which is *Quadlink*-approved, but so far, the memory and the adapter work fine. In fact, in the PC mode, all of my IBM PC's peripherals functioned properly, except for the color of the on-screen displays.

I use a medium-resolution composite color monitor instead of a top-dollar RGB monitor. When I tried my color monitor, no amount of coaxing could elicit hues other than black and white from the composite output of the *Quadlink*. On a monochrome monitor brightness levels appeared to be somewhat scrambled when using the composite output. I checked and made sure that true colors were available on my color/graphics adapter's composite output. I was unable to determine whether the colorlessness of my display was a compatibility or a Quadlink problem.

Quadlink as Art

Overall, I found the Quadlink to be amazing—pressing a few keys changed one computer into another and back again. As with any work of art or even with a masterpiece, if you look hard enough, you'll find flaws. But the whole of the work transcends these flaws and becomes something of great value.

If you want to make a transition from the world according to Apple to the world according to IBM, the Quadlink will make the going much easier. You can transfer all of your valuable text files, from client lists and form letters to novels and instruction manuals, from one disk format and computer to another. If you have Apple programs that you still regularly use but want access to both the IBM PC's power and library with only one machine cluttering your desk, the Quadlink is the perfect solution. If you have a PC at work and an Apple at home, the Quadlink will bring the two together, for better or worse. ■



Is IBM The Worm In Apple's Future?

Apple's rags-to-riches story is unrivalled in any industry, but changing market demands and competition from IBM represent clouds on the horizon.

Popular American mythology assumes that the kid who starts on the bottom of the heap and, through hard work and intelligence, fights his or her way to the top usually gets to stay there. However, Apple Computer Inc., the microcomputer industry's rags-to-riches fairy-tale company, may not be so lucky.

Almost \$10 billion worth of desktop and personal computers were sold worldwide in 1983, \$6 billion worth in the United States. Conservative estimates indicate that sales will grow to some \$22 billion by 1986, of which the United States will account for some \$13.5 billion. There's a lot of money out there, and until very recently, Apple Computer was taking in a very large proportion of that money and they hope to continue to do so.

Apple's remarkable performance is unmatched by other companies. Admittedly, in the early years of its existence, Apple's growth was slow, with annual revenues of just \$800,000 in 1977. But the company's fortunes began to skyrocket with growth rates of 915 percent and 509 percent in 1978 and 1979, respectively. Revenues in 1979 reached nearly \$48 million.

At that point, Apple was being cited in every news story that referred to microcomputers. Apple computers were not only accepted by the public as reliable, easy to use, and fully supported, but its hardware and software products were successfully marketed to educational institutions.

The rate of Apple's corporate growth began to slow in 1980 and 1981, although revenues climbed to nearly \$335 million in 1981. Apple may have reached the top of a classic slanted-S curve. Revenues increased by "only" 74 percent in 1982 and 69 percent in 1983, peaking at \$983 million.

Of course, Apple now has an installed base of well over one million machines, which provides a continuing stream of add-on, upgrade, and replacement business, especially in software sales. In addition,

a large and capable community of third-party vendors provides a broad array of add-on (and modification) hardware and software products for Apple's personal computers. While some of Apple's products are in direct competition with the look-alikes, it is this total expanse of Apple-compatible peripherals and software which is the real Apple image.

That image helped Apple sales grow from less than \$1 million to nearly \$1 billion in just 6 years. That's phenomenal—but not sustainable.

The PC had a very good supply of third-party software waiting when it arrived on the scene.

IBM: Riches to More Riches

As Apple's growth started to slow, IBM made its own small miracle on the personal computer market. According to Frank Gens, senior analyst for the Yankee Group, a Boston-based market research and consulting firm, one major reason the PC did so well was that "it was from IBM. When the software vendors saw IBM was coming out with a PC, they thought, 'The IBM logo will do very well, therefore I'm going to write applications.' So the PC had a very good supply of third-party software waiting when it arrived on the scene.

"A second effect was the perception on the part of the PC-buying community that the IBM logo would guarantee longevity in the market. That's very important in light of the departure of a number of computer vendors in the recent past. Nobody wants to buy the high-tech version of the four-track tape player."

In 1983, Apple tried to regain its momentum by introducing its new Lisa

microcomputer. Although Apple spent nearly \$50 million to develop it, Lisa did not do as well as expected. Apple shipped approximately 15,000 units in 1983, less than a third of its target of 50,000. The Apple IIe has been more successful, with about 70,000 of these units shipped per month. But the Apple III has also been a disappointment, largely due to technical problems at the starting gate.

Why the problem with the heavily advertised Lisa? It was introduced with a 6-month delivery time, software capabilities that were limited to the Lisa itself, and a \$9,995 price tag. Lisa was pulled back and made compatible with other Apple software, and the price was lowered to \$8,190, but the damage was done.

Widespread leaks about the upcoming introduction of Macintosh, a smaller, lower-priced version, also affected Lisa's sales. Many prospective customers liked the functional richness of Lisa but felt that they might as well wait and see what Macintosh was all about (which should be known by the time you read this article). Moreover, Apple III prospective customers who preferred Lisa but couldn't justify its higher price were also waiting for Macintosh.

In effect, Apple "shot itself in the foot" by not keeping Macintosh secret. Additionally, during this period, IBM introduced its PC-XT, XT/370, 3270 PC and PCjr, further worsening Apple's competitive position. More recently, Tandy introduced its TRS-80 model 2000, claiming a nearly three-fold increase in performance over the PC-XT.

And while Apple was stumbling along, IBM began to hit its stride. IBM, which in 1980 had a zero share of the microcomputer market, is now widely recognized as one of its leaders, and when 1983 market results are calculated, we may learn that IBM has officially taken over the number two position. IBM's MS-DOS operating system has become the standard for 16-bit personal computers, an unprecedented amount of support has been supplied by outside software and hardware vendors,

and the PC has almost single-handedly transformed the personal computer from a novelty item to a basic piece of business equipment. By the end of 1983, IBM had shipped almost one million PCs to users ranging from schools to small businesses to large corporations.

Price Competition Hurts

Apple's success was based on the business/home market and the professional and small business markets. Because it was there first and because of the huge market potential, Apple was able to achieve market leadership and tremendous growth while maintaining high profit margins. However, these market segments have now become fiercely price-competitive. Attempting to preserve its margins has caused much of Apple's product line to become overpriced, and competitors are making substantial inroads.

Price wars have cut deeply into Apple's profitability. Other companies came in and offered more performance for the same dollars. For example, the Apple IIe and III computers run in the \$2,000 to \$5,000 price range, and the new Lisa hovers in the \$5,000 to \$10,000 area. IBM's PC with all the trimmings comes in at about \$5,000 and the PCjr starts at about \$1,200. And Commodore's computers cost an average of \$150 to \$500 each. Apple now faces trying to preserve its margins while maintaining competitive prices and market share.

Higher margins can be realized by selling more complex and expensive equipment to medium- and large-sized businesses and other organizations. In this market, extreme pricing pressures are somewhat tempered by the value placed on support and maintenance. In addition, the value of individual sales is higher. This can be an extremely lucrative market, and Apple is attempting to restructure itself and its dealers to penetrate it.

However, there are major problems. Apple achieved its present success using a loosely controlled and, at times, poorly disciplined collection of retail outlets and



Apple is walking a tightrope between upgrading its sales facilities and losing the dealers it depends on.

distributors. The company's organizational structure is tailored toward supporting dealers and, to some extent, value-added resellers and original equipment manufacturers. Apple does not have an effective organization geared toward directly marketing, supporting, and selling its computers to medium-sized and large organizations. It is now making meaningful attempts to change that situation.

A Major Change of Direction

In response to its new competition and the promise of the emerging market in office automation, Apple's new business plans are forcing its dealers to respond. These plans require dealers to allocate floor space to demonstration rooms and training facilities as well as to stock additional Apple systems, hire outside sales representatives, and commit to calling on medium-sized and large corporations.

Apple is not only getting tough with its recognized distributors, it is cracking down on the mail-order houses who want

to buy Apple products at a discount and sell them to the mass market. Apple feels that its customers are not serviced properly under these conditions and that the company image would be tarnished. Apple has instituted legal proceedings against the mail-order companies and, so far, it has won.

How dealers will respond to these new policies is uncertain. Apple is walking a tightrope between upgrading its sales facilities and losing the dealers it depends on. Apple has faced defections and even some litigation problems from dealers who resent the policy changes.

In addition, Apple may need more than disciplined dealers to make large inroads into the medium-sized and large corporation market. Potential corporate customers are generally reluctant to deal with independent retailers. They are looking for specialized help and highly professional support services from a network of trained salespeople. IBM has about 8,400 salespeople and 650 sales branches in the United States, but Apple has only 100 salespeople and 12 branches.

New Products for New Markets

In addition to developing a new class of dealers, Apple must develop larger and different products and place more emphasis on business-oriented software, communications, and networking. In this market Apple competes with the entrenched suppliers. IBM's success with the PC and PC-XT exemplifies the powerful forces with which Apple must contend. In addition to IBM, Apple must face Wang, DEC, Hewlett-Packard, Texas Instruments, Tandy, Xerox, Commodore, and a host of smaller competitors. Abroad, Apple confronts the Japanese (NEC, Oki, Fujitsu, Hitachi, Sharp), who have the benefit of favoritism in their own country plus the international experience of their worldwide trading companies. In Europe, Olivetti, Philips, Triumph Adler, Nixdorf, and many other indigenous firms are powerfully established.

IBM, on the other hand, does not mere-

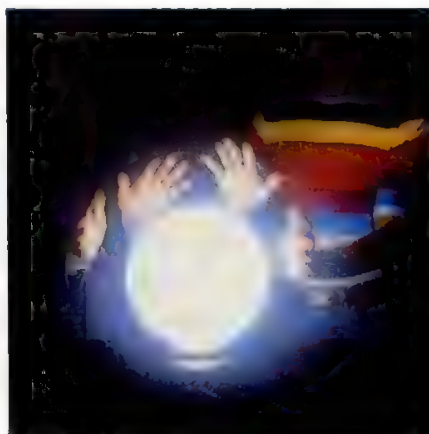
ly exploit foreign markets; it successfully integrates itself into the economy and fabric of each nation. In countries such as France, IBM not only sells its products, it conducts research and development, manufacturing, and import/export activities, employing local management personnel and thousands of workers. Thus, IBM can claim to be a national asset as well as an American multinational company.

This has been a strategic weapon of immeasurable importance for IBM. A general rule for marketing abroad in highly competitive markets is that you can either be profitable or you can establish yourself in a new market and grow—but not both. Apple, which does not already have an important presence abroad, might find establishing one a slow, expensive, and high-risk proposition.

Other considerations impede Apple's adjustment to the current market. Many forecasters believe that in the future, perhaps within the next 5 years, the hardware component of personal and small-business computers, intelligent computer terminals, word processors, and professional workstations will become virtually identical, differentiated only by optional software and peripherals.

In the business market, compatibility with IBM (and perhaps other) host processors will be a necessity. The compatibility problem is vital to Apple's access to the market. Apple must provide access to IBM systems competitive with the access IBM provides for its own PCs. As a start in this direction, Apple is expected to support MS-DOS as an option in the near future.

According to Frank Gens, Apple's best bet may be to stick with its traditional market of home and small-business users rather than venture into the world of the Fortune 1000. "There are clearly going to be very strong ties between mini-sized and personal computers. But Apple doesn't offer a minicomputer. They're trying to grow from the bottom up by offering workstations. But what happens when some workstation users want to cluster



In the future, the hardware component of personal and small-business computers, intelligent computer terminals, word processors, and professional workstations will become virtually identical.

around a larger system?"

While IBM is not going to let up on the personal computer market, especially considering its recent introduction of such machines as the 3270 PC and the PCjr, Gens thinks that it will also pay a great deal of attention to the large-business community. "It will integrate its personal computer products more tightly with larger IBM systems," he says. "This is a key strategy in controlling Fortune 1000 computer sales, and if IBM can provide hooks between the PC and larger systems, that is an excellent way to elevate an already established advantage.

"This can tie into the movement of the personal computer from an entirely open operating system to proprietary hardware and software—as in the IBM XT/370, where you put in three boards that allow it to run an IBM-proprietary operating system. Nobody else makes that operating system, or IBM 370 compatible hardware." By giving a personal computer mainframe capabilities, IBM can provide top corporations with services that Apple cannot imitate.

Gens feels that Apple can still hold its own if it sticks to its guns. "Apple can be much more successful in the middle-sized to small companies, and they can do very, very well. But they're up against some stiff competition. I think that IBM will be fairly competitive in the low-end personal computer market, but I don't think it'll be the price performance leader. IBM is rather fiscally conservative. There is a mandate to get x-percent return on investment on all of its products. Typically, that precludes it from being the lowest priced supplier on the market.

"Its costs will probably be lower than Apple's other competitors because of the volumes they'll be shipping, which would suggest that the pricing would be lower. But IBM typically looks for a higher return on its products. For example, in some ways the PCjr has been priced very aggressively compared to an Apple IIe, but it is more expensive than something like the Coleco Adam."

1984 is a critical year for Apple. The decisions that Apple executives make in the next 12 months will have a crucial effect on the future of the company. They may well determine whether Apple continues to hold its rank among the world's top microcomputer manufacturers. ■

Robert T. Fertig is the founder and president of Enterprise Information Systems, Inc., a consulting, research study, and forum organization company in Greenwich, Connecticut. He also writes columns for several newspapers, reports, and newsletters.

Merging Medicine With The Micro

A software development firm called Trinity Computing Systems installs microcomputer systems in hospitals where mainframes and minis had been a long tradition.



James Pritchett and Dana Sellers of Trinity Computing.

In the intensive care unit (ICU) at Ben Taub Hospital in Houston, Texas, the patients themselves are nearly indistinguishable beneath the breathing apparatus, monitors, tubes, and life support devices required to keep their bodies functioning. But at least one face is familiar on this ICU: the PC-XT. Though a relative stranger to these environs, this microcomputer is appropriately antiseptic-looking, housed in a white linoleum, formica, and latex room. At Ben Taub ICU the IBM XT has become as much a part of the care and treatment of traumatized patients as the oxygen tanks, heart monitors, and the intravenous infusion.

Ben Taub is one of about thirty hospitals across the country that has installed computer systems with the help of a soft-

MERGING MEDICINE

ware development firm called Trinity Computing Systems, in Houston, Texas.

Trinity was formed with the idea that the merging of medicine and the micro was not as impossible as some medical professionals and hospital bureaucrats believed. President Jim Pritchett and his partner Dana Sellers were both IBM employees in Houston during the 1970s and had sold mainframe computers to many of the oil barons who were building glass skyscrapers downtown.

"We recognized an opportunity," Pritchett related. "At IBM everywhere you went you saw a CRT. In hospitals things were dramatically different. Computers

were limited to accounting or to the hotel-like functions of administration. Clinical applications were for the most part neglected, and if any were used at all, they were the more expensive minis and mainframes.

"In fact, there was one hospital administrator in town who was proud that he had never laid a finger on a micro in his life. I realized things were changing though when I saw a classified ad in the local newspaper for a hospital looking for a computer technician with micro experience."

Trinity's original plan was for hospitals to use microcomputers in a local area net-

work (LAN) for both clinical and administrative duties. The company's first product, which was based on the Nestar Plan 4000 LAN, was called CardioNet. This test and information analysis network for a hospital cardiology department features a cath lab support system, an echocardiology support system, critical care support system, pacemaker follow-up system, stress test analysis and administrative system. The network was designed for use on the Apple II.

No Success with Apples

At first the company experienced limited success, much of which was caused by the name of the micro itself. At the time, the Apple II was the only game in

A Radiology Network

Trinity Computing Systems presents a new microcomputer LAN for hospital use.

One of the more specialized hospital services now being addressed by software manufacturers is radiology. Trinity Computing Systems recently presented a new microcomputer network called Radiology Support System, which should radically increase the efficiency of hospital X-ray units.

Trinity, which introduced its new system at the Chicago meeting of the Radiological Society of North America last November 13th, has specialized in medical computer systems since its inception in 1981. It has already provided the medical community with computer networks such as Cardionet (which tracks all the support systems needed by a cardiology team), the Radiology Teaching File (which offers patient case material for research and education purposes), and one for an ICU (see accompanying article).

Its newest package, Radiology Support System, was developed to facilitate the maintenance of patients' X-ray files. Using an IBM PC with single floppy disk drive, a Nestar local area network, bar code readers, and a printer, hospital

staff members can record information about each patient and keep them on-line for immediate access. It also helps track transfers of X-ray films, which can be easily mislaid or misfiled. A bar code printer is used on patient files to identify physicians, floors, and clinics—thus enabling administration staff members to keep a steady record of who has walked away with which folder.

According to Trinity's Dana Sellers, the Radiology Support System will soon be adding other features, giving it the capability to handle scheduling, room utilization, patient tracking, and quality control for X-ray films. She also stated that among the five or six similar systems that were introduced at the conference, Trinity's is unique. "This is the only one that utilizes local area networking," she said. "The others all use mini rather than microcomputers." This, Sellers added, allows hospital staffs more modularity and provides for a lower entry level price, a serious consideration for small hospitals coping with a tight financial climate.

—Barbara Krasnoff

People look at the IBM PC as a diagnostic tool not as a microcomputer.

town, and in a medical community accustomed to IBM mainframes and DEC minis, it was considered strictly a toy.

When the IBM PC was introduced in 1982 Trinity immediately translated all its software to MS-DOS and converted its networks to the IBM PC. It continues to maintain and service Apple clients, but it hasn't sold a single Apple network since.

Pritchett said, "People look at the IBM PC as a diagnostic tool not as a microcomputer. It gave us the credibility we needed with the hospitals. From a technical side there were advantages, too—increased memory, speed—but, frankly, the real plus was in marketing. With IBM we have encountered fewer barriers."

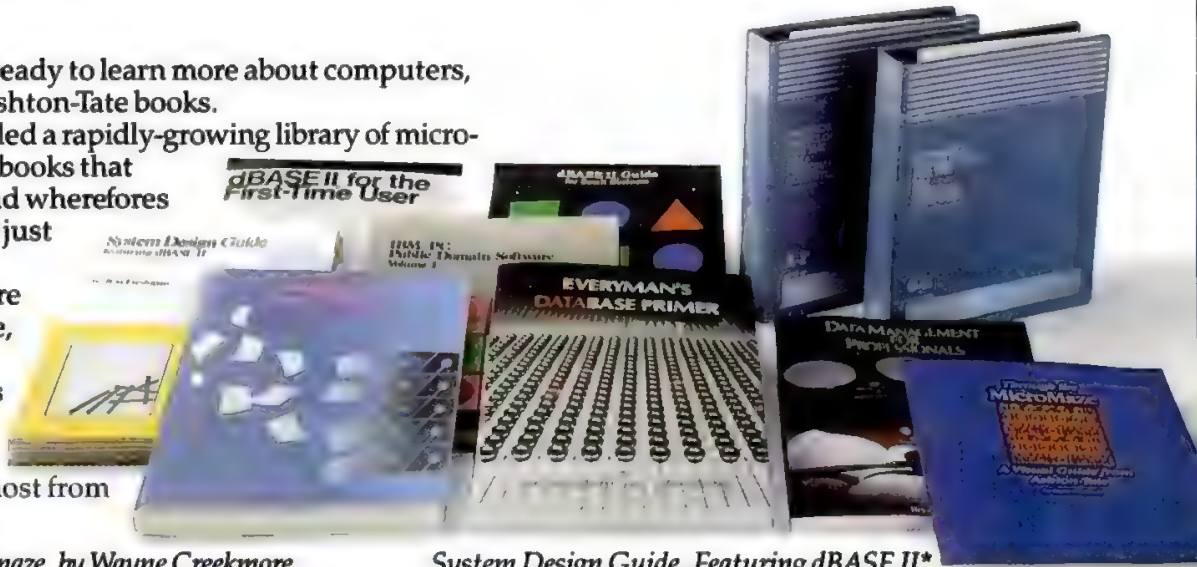
In working with hospitals Trinity had more than brand name awareness to contend with. Digital Equipment Corporation minis have long been entrenched in hospitals, and, according to some physicians, this company is even better known in the medical setting than IBM. It was up to

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MERGING MEDICINE

Trinity to convince the hospital physicians that a micro network could do the job of numerous minis with greater flexibility at a fraction of the cost. Each Trinity system is customized and can cost from \$30,000 to \$250,000.

Cost saving is of particular interest to hospital administrators these days since the enactment of a new Medicare Law called Diagnosis Related Groups (DRG). The result of the new federal legislation is that hospitals will no longer be allowed to determine their own costs for particular types of care (that is, broken arms, heart surgery, and so forth). They are now regulated by a nationally supervised price chart. The result, according to Pritchett, is that "Hospitals are all looking at how to save money. Data processing is the logical answer."

"There are hospitals out there with 25 minis and 25 operators doing work that a micro network does better," Sellers added. "It takes a great deal of explaining, but slowly they seem to be coming around to the idea."

"Networks offer a great potential in hospitals. Besides the cost advantages compared with a mini, there is greater flexibility and reliability with a micro network. Each workstation is its own computer. Instead of taking away from the network when they are at work, they actually contribute to the overall operation. Besides, the network offers great growth potential. Ben Taub Hospital is currently using only one computer in the ICU, but the system can easily grow to as many as 255 micros on a single file server." What follows is an account of the IBM PC-XT at work in the ICU at this hospital.

An XT in the ICU

The newest admission to the ICU wing at Ben Taub Hospital is a 29-year-old white male who had been moved from the hospital's operating room following an arterial bypass in his left shoulder. His condition is stable. Despite his relatively young age, this patient has suffered from heart disease for many years.

He is stationed in a far bed on the ICU, attached to a Swan Ganz monitor that sinks a balloon into the heart and directly measures the pressure in the pulmonary artery and is put through a routine battery of critical care tests, so the staff can gather information about his condition.



Bitondo and Dr. Bray confer about the computer printout for a heart patient.

Physician's assistant Carmel Bitondo then takes the raw data gathered by the staff and approaches the PC-XT that has been placed outside the nursing station. It is her job to input the data—ranging from the routine name, age, occupation, and so forth, to the monitor reports—and then to generate a series of graphs and a report on the condition of the patient.

Bitondo sits at the PC keyboard and enters the data so that the computer work-up will be ready and attached to the patient's chart when the doctor arrives. She concentrates on cardiovascular/renal support that she will repeat at given intervals throughout that afternoon. She generates a hemodynamic tracking profile, congestive heart failure graph, and acid base chart graph from the numbers, studies the red bar lines against a royal blue background on the IBM color monitor, and then prints them out.

The "numbers" for the 29-year-old heart patient are encouraging, but the cal-

culations that the Trinity program produces indicate trouble. Bitondo studies the rows of figures generated by the printer. She immediately suspects sepsis, an infection in the bloodstream.

Dr. Bray is the first physician to see the figures. He enters the ICU for an inter-

view, and Bitondo hands him the printout without mentioning her suspicions. He arrives at the same diagnosis himself—septic shock, a common post-operative condition with about a 40 percent mortality rate. Based on the information, his prescription is to draw tissue cultures and to administer prophylactic antibiotics.

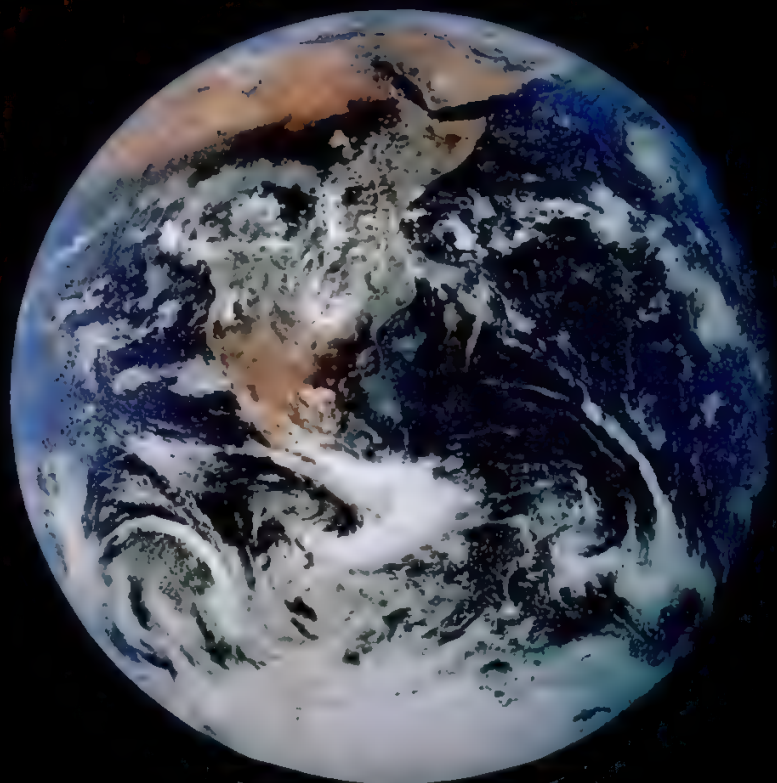
And it was the PC-XT that made the diagnosis?

"The computer doesn't diagnose for us," he emphasized. "In fact, it doesn't do things that we weren't able to do before. It simply makes calculations that used to be incredibly difficult and also allows us to spot trends and make a diagnosis in less time."

How long does it take to learn how to operate the XT and the program?

Bray replied with an answer that is as blunt as it is wry, "It takes someone about twenty minutes to learn how to run the program. It takes 10 years of medical school to learn how to analyze it." ■

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STARFIRE GAMES
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CIRCLE 37 ON READER SERVICE CARD

WASHINGTON (UPI) — The U.S. Air Force/NASA have developed an experimental spacecraft given the title XTM. Due to the vague description as to the design or purpose of the XTM, the press is still in the dark about many aspects of the craft or its intended mission. It has been discovered, however, that at least three pilots have been lost in the current flight testing program of the mysterious

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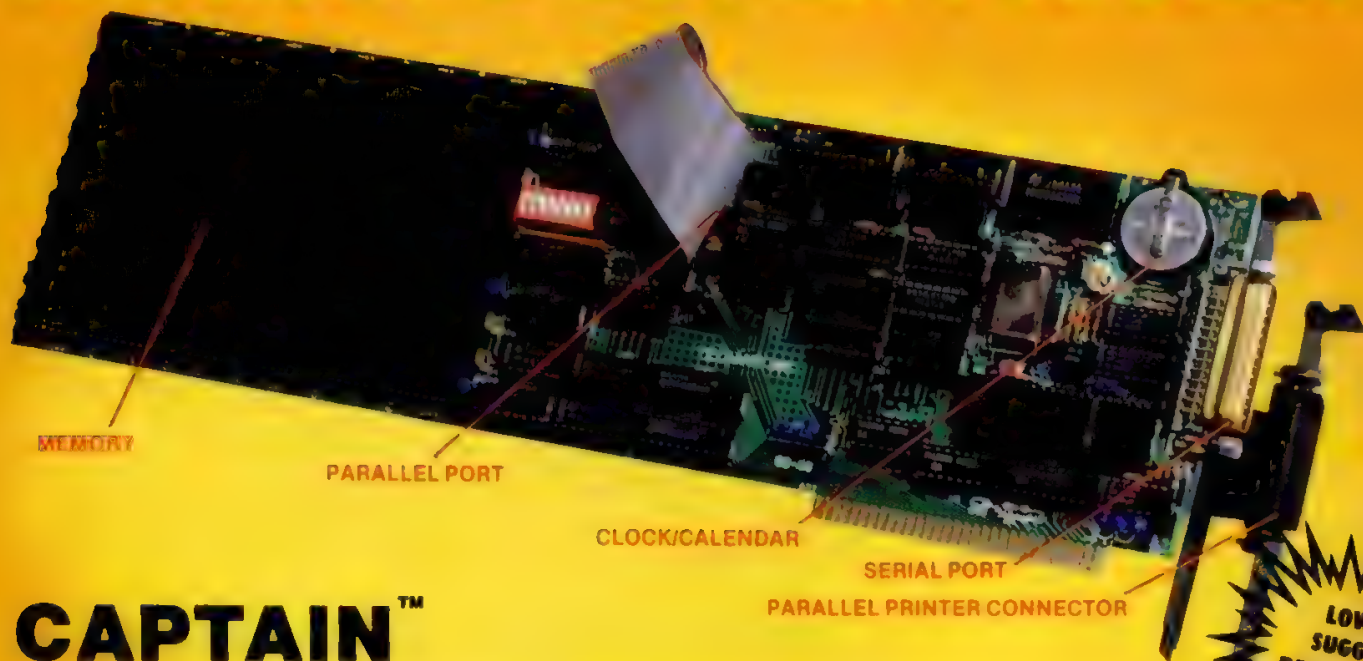
Not far into the mission, you discover this task is more than you could have imagined. Never knowing what you will encounter next, you maneuver your ship from one

adventure to another. You draw upon every resource to survive events ranging from battles with Vikings in the past to outwitting aliens in the future for your ship, the lost pilots, even your very life. But prepare, your final challenge is to return to your own time era safely, a feat which has not been accomplished by any pilot before you. Time Machine I is available for your IBM PC or XT (64K, disk drive), Apple II+ or IIe (48K, disk drive, DOS 3.3), Commodore 64 (cassette or disk drive), Atari 400 and 800 (48K, disk drive). TRS-80 version to be released soon.

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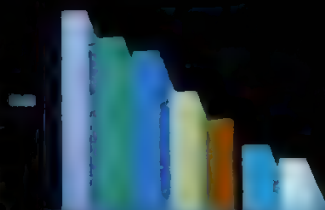
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Putting A Ph.D. In Your PC

Bringing the principles of Artificial Intelligence to the PC, Expert-Ease allows experts in many fields to program their knowledge into a computer to help novices solve problems.

Expert-Ease (EE) is a fascinating new software package that, for the first time, allows experts in any field to create problem-solving "expert systems" on a microcomputer. Developed under the leadership of an Edinburgh University professor of machine intelligence, EE is probably the first commercial applications program to bring the

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principles of Artificial Intelligence to the IBM PC. (See sidebar, "What Is Artificial Intelligence?")

Expert systems distill the specialized knowledge of an expert into a computer program that anyone can use. So long as the program takes the same steps that a human expert uses to solve problems, a novice with a PC can theoretically be a match for the most learned specialist. Some day, expert systems will be widely used to diagnose diseases, trouble-shoot faulty machinery, and even make business decisions. We're not there yet, but *Expert-Ease* is a big step in the right direction.

The program, in effect, generates expert systems. It can be used to create and run any number of such systems. Some problems are clearly better suited

than others to this kind of solution, but EE's approach is so general that its possible applications are limited only by the imagination of the user.

Expert systems work by inductive reasoning, that is, by figuring out general principles based on specific examples. A human expert must feed *Expert-Ease* its examples; it doesn't come with any advance "knowledge" of how the world works. But if the program is given enough examples, it will "learn" to recognize rules and patterns.

Once the system has mastered the rules, a nonexpert can use it to draw conclusions about new problems. The program "asks" the nonexpert a series of questions about the problem and comes up with a recommendation or decision based on the rules it has derived from the old

EXPERTS

examples. By continually prompting users for information, the system guides them to an expert solution. This human/machine dialogue is the hallmark of all expert systems.

As we shall see, *EE* can deal only with new situations that match the examples already given to it by the human expert. It cannot make educated guesses about cases for which it is not perfectly prepared. Also, it is somewhat single-minded about the way it solves problems; it always uses the same "decision tree" algorithm. But the best way to understand the program is to take a look at how it works.

What Manner of Beast?

Let's assume for a moment that we have been commissioned by visitors from outer space to devise a simple way to help them identify terrestrial animals. Compared to anyone from another planet, we are all "experts" in identifying animals and we can use *EE* to bundle that expert knowledge into a simple-to-use computer program. The first thing we need to do is think about the different things we look for when we tell one animal from another. Most of the time, we distinguish between animals immediately; we don't go through a lengthy mental checklist of attributes to make sure that what might be a horse isn't really a duck. But in building an expert system, we have to work out just such a series of idiot-proof tests that will always give accurate results.

Therefore, the first thing *EE* requires us to do is establish the key factors that should help our extra-terrestrial friends tell animals apart. Figure 1 is a printout of what the program calls an attribute screen. In the first two rows of the matrix we have put the names of the key attributes and an indication of whether those attributes should be described logically or numerically. In the columns below each attribute are some possible values for it.

Attributes can be thought of as the questions that the expert system will ask the user, and values as the possible replies. For example, one way to tell some animals

EXPERT-EASE Attribute Listing, Problem: ANIMALS						Date: 16-dec-83
	head	feet	legs	surface	temp	class
	logical	logical	integer	logical	logical	logical
	-----	-----	-----	-----	-----	-----
1	horns	toes		smooth	cold	cow
2	antlers	hooves		scaly	warm	
3				furry		

Figure 1: A printout of an attribute screen.

EXPERT-EASE Example Listing, Problem: ANIMALS						Date: 16-nov-83
	head	feet	legs	surface	temp	class
	logical	logical	integer	logical	logical	logical
	-----	-----	-----	-----	-----	-----
1	horns	hooves	4	smooth	warm	cow
2	antlers	hooves	4	smooth	warm	deer
3	*	toes	4	smooth	warm	human
4	*	toes	4	furry	warm	monkey
5	*	*	0	scaly	cold	snake
6	*	*	6	scaly	cold	insect
7	*	*	8	scaly	cold	spider
8	*	claws	2	feathery	warm	bird
9	*	webbing	2	feathery	warm	duck
10	*	claws	4	furry	warm	cat_or_dog
11	neither	hooves	4	smooth	warm	horse
12	horns	*	4	leathery	warm	rhinoceros
13	trunk	*	4	leathery	warm	elephant
14	*	webbing	4	smooth	cold	frog

Figure 2: An example screen for the animal identification program.

apart is by what grows out of their heads. Thus, the first attribute, "head," will be a question about what kind of headgear an animal has; so far, we have thought of horns and antlers.

The third column, "legs," is blank because it is a numerical attribute. We have set it up so that when *EE* goes to work it will ask us for the number of legs rather than for some logical quality such as whether the legs are short, long, thick, or thin. Since *EE* can accept any integer from -32766 to +32767 as possible input, it makes no sense to list the range of possible variables for this attribute. If we thought it

was important, we could always add another logical attribute to test for length and shape of legs, but for now we'll see if we can get along without it. In a full-blown application, *EE* can handle up to 31 different attributes—that is, ask 31 different questions—and deal with as many as 255 different logical values per attribute.

The last column, the one labelled "class," begins a list of the animals the program should be able to tell apart by asking about the attributes in the preceding columns. Depending on whether an animal is cold-blooded, furry, or has horns, etc., *EE* will take a stab at telling us what it

EXPERTS

is. These values are the possible "conclusions" or "recommendations" of the expert system we are generating.

We don't have to come up with all the values for our attributes right from the start. We can add them as they occur to us or remove values if we come up with better ones. So long as we have decided on the attributes we will use (head, feet, legs, body temperature, etc.) we can start inputting examples (Figure 2) and fill in new values as needed. Also, we can always add new attributes or get rid of old ones if we think of better questions that *EE* should ask the user.

Building up an *EE* screen is just like working with a spreadsheet: We put the cursor where we want the new value and just type it in. The matrix imposes space limitations, so it is occasionally necessary to abbreviate entries. The conventions used in building an attribute screen or example screen are clearly explained in the documentation.

Inputting Examples

Accurate examples are the heart of *Expert-Ease*. Because it bases its decisions only on what we have told it, the more examples we give it, the more accurate its results will be. Since *EE* is a p-System program and can therefore use only 128K of RAM, it will run out of memory after two or three hundred examples, depending on how many attributes we use. In this case, we'll make do with 14 examples.

Figure 2 is the example screen for our animal identification program and lists the animals—each is an example—that we have entered into the program, according to the attributes we chose earlier. *EE* should now know how to distinguish between 14 different kinds of animals. If it finds out, as in example 1, that what we have on our hands is horned, hooved, four-legged, smooth-surfaced, and warm-blooded, *EE* will report with complete confidence that we are dealing with a cow. An asterisk means that a particular attribute is not necessary for identifying that

animal; *EE* can overlook it entirely. Thus, in example 3, the program can recognize a human without worrying about what might be growing out of its head.

Example 10 is a bit of a problem. Both cats and dogs have the same values for all the attributes we have chosen. To distinguish between them, we would have to add another attribute such as skull structure or shape of teeth. For now, we'll just lump cats and dogs together.

As we filled in the example screen, we found we had to invent new values for some of the attributes. *EE* automatically added these to the attribute screen, so that by the time we have finished with the examples, it looks like Figure 3. Of all the new attribute values, only the third in the "head" column needs explanation. "Neither" means neither antlers nor horns; it is a value that we had to dream up in order to distinguish horses (number 11 on the example screen) from deer (number 2).

EE has a built-in error-trapping mechanism that signals the user if two contradictory examples have been inputted. If we tried to get by with an asterisk for the value of the "head" attribute when we

were inputting the horse example, the program would cry foul. In effect, it's saying that since all the other horse attributes are identical to the cow and deer attributes, we had better say something special about a horse's head to distinguish it from that of a cow or deer.

Now that our examples are in order, it's clear that if our space travellers were to show up with one of our 14 animals and answer various questions about it, *EE* would be able to tell them what manner of beast it was. However, the one-word codes we have established for attributes and their values are a little too laconic for user-friendly dialogue. If *EE* wants to know whether an animal is cold- or warm-blooded, it can't just put the abbreviation "temp" on the screen and expect the user to know how to respond. Instead, we can attach text to any of the attributes or values and *EE* will display the text rather than the code we used in the attribute and example tables.

Figure 4 is another listing of the attribute table, this time with associated lines of text. When *EE* queries the user about the "head" attribute, it will display the

EXPERT-EASE Attribute Listing, Problem: ANIMALS Date: 16-nov-83					
	head	feet	legs	surface	temp
	logical	logical	integer	logical	logical
	-----	-----	-----	-----	-----
1	horns	toes		smooth	cold
2	antlers	hooves		scaly	warm
3	neither	webbing		furry	
4	trunk	claws		feathery	
5				leathery	
6					
7					
8					
9					
10					
11					
12					
13					
14					
					cow
					deer
					human
					monkey
					snake
					insect
					spider
					bird
					duck
					cat_or_dog
					horse
					rhinoceros
					elephant
					frog

Figure 3: The completed attribute screen for the animal program.

EXPERTS

text to the right of each set of colons. Likewise, when *EE* tells us that we have a cat or a dog, it will again display the text to the right of the colon. If we had attached no additional text to an attribute value, the original one-word code would be displayed. Figure 5 is how *EE* would ask about an animal's headgear. The user would enter the appropriate number and *EE* would move on to the next question.

A Decision Tree

Obviously, there is a smart way and a stupid way to identify these animals. The stupid, brute-force way would be for *EE* to go through all five attributes and ask about each one. Then it could compare the responses with the example table and identify the animal. *EE* can do a lot better than that, and therein lies a good deal of its "intelligence." Given a set of examples, the program can strip away the inessential attributes and come up with the most efficient sequence of questions eliciting the minimum number of responses necessary to identify an animal. The program figures out the cleverest rules for identifying the 14 animals.

We have to give *EE* a special "impute" command in order for it to do this, and it huffs and puffs for a while before it comes up with the best line of reasoning. The result is Figure 6, which is an example of what *EE* calls a rule. It is really a decision tree that outlines the most efficient use of data for identifying our animals.

The tree is laid out from top-left to bottom-right, and indicates the information for which *EE* prompts the user and the questions it goes on to ask on the basis of information received. The tree is clearer when it is redrawn in a more traditional manner, as shown in Figure 7. Here, prompts for information are followed by question marks, and conclusions are underlined. The other items in the tree are data that could be input by the user in response to *EE*'s prompts. All *EE* does to identify animals is simply follow the different branches of the tree.

The first thing *EE* always asks about is

EXPERT-EASE Attribute Listing, Problem: ANIMALS Date: 16-nov-83

```
head      : The head has . . .
  horns   :
  antlers :
  neither :      neither horns nor antlers
  trunk   :

feet      : The feet have . . .
  toes    :
  hooves  :
  webbing :
  claws   :

legs      : How many legs?

surface   : Describe the surface.
  smooth  :
  scaly   :
  furry   :
  feathery :
  leathery :

temp      : What is the temperature?
  cold    :
  warm    :

class     : The beast is . . .
  cow     :
  deer    :
  human   :
  monkey  :
  snake   :
  insect  :
  spider  :
  bird    :
  duck    :
  cat_or_dog : probably a cat but it might be a dog. Hold for further investigation.
  horse   :
  rhinoceros :
  elephant :
  frog    :
```

Figure 4: A listing of the attribute table with associated lines of text.

the surface of the animal. If, in response, we report that the surface is leathery, then *EE* always asks what grows out of the animal's head. If we say the animal has horns, then *EE* correctly identifies the animal as a rhinoceros. If we claimed we had a leathery-skinned animal with antlers, *EE* would tell us that this was a null category—there is no such animal in its list of examples.

EE can thus identify leathery animals

by asking only two questions. During the induction process, when it generated the rule for animal identification, *EE* figured out that what makes a rhinoceros unique is its unusual combination of leathery skin and horns. It doesn't trouble us with questions about how many legs it has or whether or not it's warm-blooded. *EE* only asks for the information it needs.

Of the 14 animals in our menagerie, only cows, deer, and horses are similar

EXPERTS

```

-----
EXPERT-EASE  file:  ANIMALS
-----
The head has . . .

  1. horns
  2. antlers
  3. neither horns nor antlers
  4. trunk
-----

```

```

running ANIMALS
Enter value 1..4
>
-----

```

Figure 5: Expert-Ease queries the user.

EXPERT-EASE Rule Listing, Problem: ANIMALS Date: 16-nov-83

```

surface
  smooth : feet
    toes : human
    hooves : head
      horns : cow
      antlers : deer
      neither : horse
      trunk : null
    webbing : frog
    claws : null
  scaly : legs
    <3 : snake
    >=3 : legs
      <7 : insect
      >=7 : spider
  furry : feet
    toes : monkey
    hooves : null
    webbing : null
    claws : cat_or_dog
  feathery : feet
    toes : null
    hooves : null
    webbing : duck
    claws : bird
  leathery : head
    horns : rhinoceros
    antlers : null
    neither : null
    trunk : elephant

```

Figure 6: The Expert-Ease "rule" listing is really a decision tree.

enough for *EE* to have to ask three questions in order to tell them apart. In every other case, two questions is all *EE* will ever ask. For scaly-surfaced creatures, it appears that *EE* asks the number-of-legs question twice, but that's not so. Instead, the program does two different operations with the same data. First *EE* tests to see whether it has fewer than three legs (the midpoint between 0 and 6). If so, the animal is a snake. If it has more than three legs, *EE* tests the number again to determine whether the animal is an insect or a spider. The two operations appear to the user as one, since in response to the question about number of legs, *EE* immediately gives the right answer.

A quick scan through the decision tree shows that *EE* never needs to know whether an animal is warm- or cold-blooded. We could throw out the whole temperature attribute and *EE* wouldn't care. Normally we tend to think of warm- or cold-bloodedness as a vital means of telling animals apart, but in fact it's almost never a crucial distinguishing factor. *EE* would worry about it only if two otherwise identical animals differed only in body temperature. That's unlikely; reptiles and insects never look much like mammals or birds. Thus, when it induces its decision-making rule, *EE* weeds out all the useless information in the example list and asks only questions that are absolutely necessary for correct identification.

Other Applications

At first glance it may seem that this name-the-animals problem is trivial. But perhaps it only seems trivial because we are asking *EE* to make identifications that anyone could make. With the same number of attributes and examples we might have set up an expert system to diagnose different kidney diseases. Assuming that 14 different conditions could be identified according to the values of five different attributes (such as X-ray results, blood test, etc.) we would have a system that could produce an expert diagnosis in return for test result data. A nonspecialist

What Is Artificial Intelligence?

The concept of Artificial Intelligence is as difficult to nail down as the "rules" experts use to solve complex problems.

Artificial Intelligence (AI) is a tricky thing to define. The experts may recognize it when they see it but be hard pressed to describe it. The question of what is—or is not—AI has gotten so fuzzy that some wags have decided that anything computers can't yet do is AI. By this definition, speech recognition rates as AI because it is still hard to make machines do it properly. But by the time someone invents a typewriter you can talk to, speech recognition will have become old hat and won't be AI anymore.

A more serious definition of AI is based on the distinction between "divergent" and "convergent" programming. Any program for which the input is small but the output is large is divergent. If you run a payroll program, or drop a quarter into a video game, you get heaps of output. By this measure, almost all programming is divergent in the sense that with a few simple commands, the machine does a lot of work and spits out pages of results.

Human thinking, on the other hand, is often convergent: lots of input but not much output. Should I go dancing tonight? Should I move to Los Angeles? The output for these problems is a simple binary choice. But the data that must be processed to make the right decision may be fiendishly complicated. In this respect, expert systems are convergent programming. They require lots of input before they make a recommendation. And the entire output of a complex program may be nothing more than a simple yes or no.

In effect, human beings are designed by nature for convergent behavior. We

have millions of sensory receptors for input but only a few hundred muscles for output. We are good at making simple choices on the basis of rich and varied data. Any computer program that mimics this kind of decision making can claim to have Artificial Intelligence. By this standard, the *Expert-Ease* program incorporates AI.

Data, Rules, and Goals

A yet more rigorous definition of AI requires that a program base its output on data, rules, and goals, rather than by matching examples the way *Expert-Ease* does. Some chess-playing programs approach this level of intelligence. The data with which they work are the position of the pieces, the rules are the set of legal moves, and the goal is to win. Such programs then search the board for opportunities that are legal moves and which will help win the game. No matter how oddly the pieces are arranged, the program can still apply the rules in order to achieve the goal. That is the way a human being would play.

A non-AI chess program could theoretically be written that contained the best move for every possible arrangement of pieces. At every stage of the game, the program would look through its vast library of cases until it found the one that matched the current board arrangement. Then it would simply make the move that the programmer had decided was best in that situation. There's a good reason, however, why no one has ever written such a brute-force program: There are about as many possible arrangements of chess pieces as there are electrons in the universe.

Expert-Ease solves problems in exactly the same way that a brute-force chess program would. *EE* must have a complete library of old examples with which to match a new example. In this sense, it is not "intelligent" enough to do anything but throw up its hands in dismay when asked to deal with a situation that is not exactly like something it has been told about already. It is the ability to apply rules and make good moves in unforeseen circumstances that gives the best chess programs their intelligence. A few good rules can take the place of lots of examples.

The trick, of course, lies in coming up with the rules. But people often can't explain the rules they use every day. A connoisseur can tell a masterpiece from schlock, but he can't draw up a list of foolproof rules that anyone else could use to make the same judgment. The real world is full of vagueness, hunches, and people who make the right choices but have no idea how they do it.

Programming the Rules

One of the hardest jobs of an AI programmer is to boil down some of those hunches to a set of rules that can be fed into a computer. If experts think hard enough, they can usually come up with some of the rules they use. The very process of using *EE* would force experts to think about how they solve problems.

AI is still a young science. Ultimately, its purpose is to build machines that behave, or at least appear to behave much like human beings as possible. In order to write programs that think, we will have to figure out how to do it ourselves. —J.T.

EXPERTS

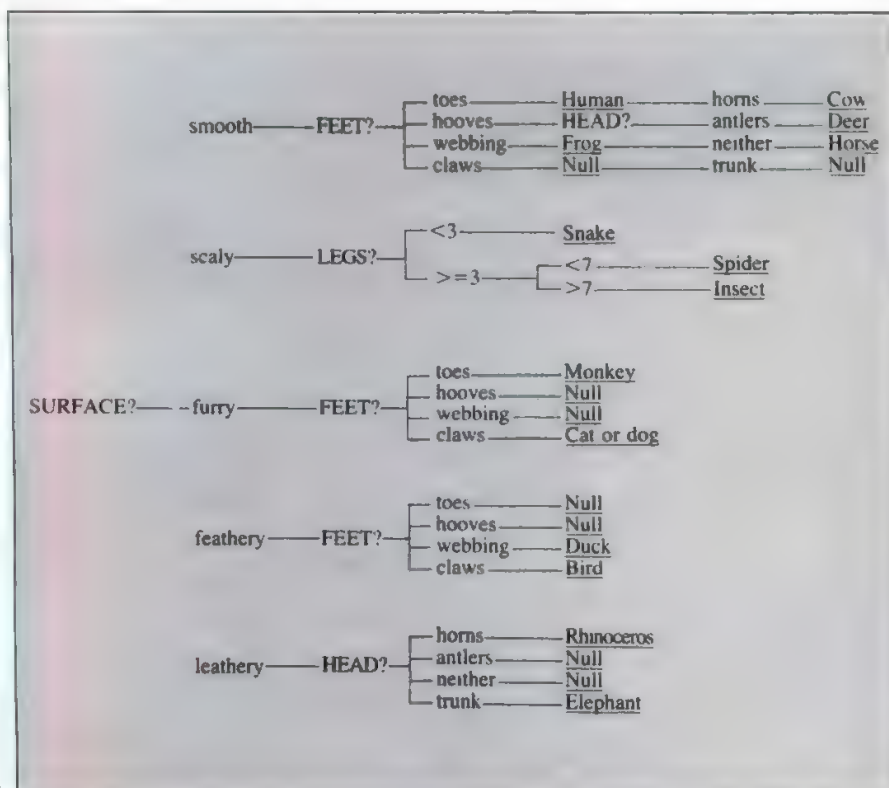


Figure 7: A more conventional presentation of the same decision tree.

could run the tests and enter the data. The computer would do the diagnosis.

Similar systems could solve binary rather than multiple choice problems. A bank, for example, could set up a system that queried a clerk about a customer's income, net worth, job history, credit record, etc. and then recommended whether or not to lend money. So long as the attributes were carefully thought out, and *EE* had enough good examples from which to derive accurate rules, the computer's recommendations would be no different from those of an experienced lending officer. Once again, *EE* would determine the most important attributes and would ask only enough questions to reach a conclusion.

Expert systems can have an endless variety of applications. In a bakery, for example, the master chef could set one up to determine why the pie crusts were coming out soggy. Assuming that he could isolate the different factors that cause soggy

pie crusts, he could design an inquiry system that an apprentice could use to solve the problem.

A program like *EE* could even be used to look for patterns in the real world that might not be evident to even the wisest expert. A historical series of weekly economic indicators might be entered as *EE* examples. The consequence, or decision, to be entered might be whether the stock market went up or down during the next week. After enough real examples were put into the *EE* model, it would be able to query the user for this week's indicators and make a prediction about where the market would go. The important indicators might not be the ones we suspected. By studying the rule that *EE* induced, we could tell which indicators it was using and which ones it was ignoring. We could then stop collecting that data that *EE* didn't need.

All this sounds pretty razzle-dazzle. Still, all expert systems have limitations

and *EE* has some obvious ones. First of all, the system is only as good as the examples it is built from. To reach a conclusion, *EE* does nothing more than match data from a new, real-world example with data that it has been fed by a human expert. If that human has not done the job right, *EE* will give bad advice.

Also, the expert who designs the system and the novice who uses it have to agree on terms. In the animals problem, "scaly" is probably not a very good description of the surface of a spider. Tarantulas are more furry than anything else and a black widow is neither furry nor scaly. That sort of ambiguity has to be avoided.

But even if the human expert does the best possible job, and the novice user understands all the terms, there are some kinds of problems for which the rules simply may not work all the time. The attributes can be refined and the number of examples increased, but some perverse example can always come along and contradict the rule.

In addition to the inherent limitations of expert systems, *EE* suffers from some special defects of its own. First, it treats all possible outcomes of the inquiry process as equally likely. When it induces its rule, it produces the decision tree with the fewest total number of branches. Thus, if the distribution of possible outcomes is equal, its decision tree is the most efficient one possible. However, if results are not evenly distributed, the decision tree may not be the most efficient.

To return to the animals problem, let's assume that our expert system is being used in a locale that is rich in snakes, spiders, and insects but where anything else is rare. As it happens, all three of these categories of animal can be distinguished by asking a single question: How many legs? A decision tree could certainly be built for which that was the first question. That way, only one piece of data would have to be entered in order to identify most of the animals in the region. The user might then have to enter more data than

would be necessary with the current tree in order to identify a cow, say, or an elephant, but the time and effort saved identifying the most common animals would more than make up the difference. In the best of all possible programs, an expert system would keep count of how many insects and elephants were identified, and after a certain period, rework the question sequence to speed up identification of the most common species.

Another *EE* defect is that its inquiry procedure pays no attention to whether a question is difficult or expensive to answer; it asks as few questions as possible. In medical diagnostics, for example, thousands of tests could be run on a patient if expense didn't matter. But expense does matter. If by running a series of cheap tests such as pulse rate, temperature, and blood count, doctors can get the same information as from an expensive CAT scan, they will never order the scan.

Ideally, *EE* would give each user the opportunity to weight each attribute by cost so that when the program creates its query sequence, it would hold off on the expensive questions, even if by doing so it had to ask more questions. If the same conclusion can be arrived at by examining more but cheaper data, it may be better to generate a decision tree that is technically less efficient but that asks the most expensive questions only when absolutely necessary.

A One-Way Program

Another problem with *EE* is that the user can't overrule the inquiry sequence and leap about in the decision tree at will. Eventually, even the dumbest user is going to learn something about the problems he is solving with the expert system. Before too long users are going to lose patience if they have to grind through every step before getting to the questions they really want to answer. With the animals problem, users may soon learn that insects look a lot like spiders and that a foolproof way to tell them apart is to enter the number of legs. They will want to go

straight to the "legs" query rather than bother telling *EE* that the animal has a scaly surface. The same could be true for identifying elephants. Users might have a hunch that a trunk was sure proof of elephants. They would want to go right to the "head" query and skip "surface." Once again, a shortcut would save time without sacrificing accuracy.

EE can't let users do this for a very good reason. If the user's hunch were wrong, the program would have to back up and ask a few more questions from the earlier part of the tree, and *EE* is strictly a one-way program. For example, if the user thought that webbed feet were a sure sign of something unique and insisted on telling *EE* about them first, the program would have to climb back down the tree and ask about the animal's surface to figure out if the animal was a duck or a frog. But in order to then give an answer, it would have to remember that the animal had webbed feet.

In fact, *EE* never remembers the data it asks for. Since the program always moves in one direction through the tree, data are nothing more than signposts that tell it which branch to take. Once it is out on a limb, it throws the data away and asks another question that will tell it which way to branch next. Once it gets to its destination, *EE* has forgotten all the information that got it there. Thus it can't first learn that an animal has webbed feet and then give the right answer as soon as it learns about the animal's surface. By the time it found out whether the animal was smooth or feathery it would have forgotten all about its webbed feet and would have to ask about them all over again.

This deficiency is related to another *EE* problem: the oracular quality of its pronouncements. The program never explains or justifies its conclusions. Any serious user of an expert system is eventually going to want to understand how the system makes up its mind. With *EE*, the only way to do that is to puzzle our way through the induced rule. It would be far more educational if we could hit an "ex-

planation" button that would review the reasoning that goes into a decision.

Explanations

Obviously, since the data are nothing more than signposts, *EE* can't generate textual explanations for what it does. Still, it would be handy if *EE* allowed the human expert to write explanation texts for each possible decision-tree path. That way, the program would have only to keep track of which path it took through the tree and then spit out, on demand, the expert's account of why the data input by the user must result in a certain conclusion.

Explanations of this kind would not only educate the nonexpert user, they would bolster the credibility of the program. Most people don't like to take orders from a computer. A mechanic, after answering all the appropriate questions asked by an auto-repair expert system, might begin to doubt the system if told—without explanation—that the problem couldn't be fixed. Though the solution might be beyond reach, the mechanic's not going to appreciate sphinx-like conclusions with no commentary.

Limitations like these mean that *EE* could be an irritating program to deal with, especially over the long run. Nevertheless, inflexibility doesn't affect the accuracy of its results. If the program's supply of examples is large enough and the attributes used in them are the ones that matter in the real world, *EE* should be able to plod through its query process and get the right answer every time.

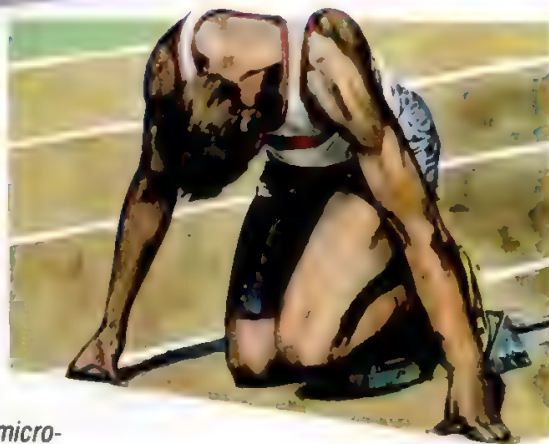
Those considering laying out \$2,000 for this program should carefully think through the problems they expect it to solve. It's important to remember that *EE*'s results are only as good as the examples it gets. Reduced to its barest elements, the program is nothing but a standard search-tree algorithm designed to collect data about new examples to see if they match old examples. In any case, *Expert-Ease* is still one of the most interesting, thought-provoking programs to come along in quite some time. ■

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Something's Happening In Silicon Glen

PCs are rolling off assembly lines in Scotland, where IBM recently opened the Advanced Materials Distribution Plant—possibly the world's largest automated warehouse.

Your typical Scotsman is one tough hombre. He lives at about the same shivery latitude as Alaskans. When he wants to dress up he steps into long gartered socks and a skirt, and he's rugged enough to pull it off without looking silly. For fun he throws immense rocks and chopped-down telephone poles called cabers. His national flower is a prickly weed. His national hero gained fame after a mystical communion with a spider. His national dish is a grayish amalgam of the pulverized parts of animals even sausage makers won't use, churned together with fat, gruel, and onions, then served in a sheep's stomach. (There's even a little ceremony for slashing the thing open, complete with poem by Robbie Burns.) It is traditionally served with a tepid orange paste called



"bashed neeps." And, of course, with a wee dram o' whiskey.

Scotland is guaranteed to bring a lump to the throat of even the most jaded world traveler. Picture-postcard lochs snuggle

between knobby heather-scented hills. Black-faced sheep and shaggy highland cattle contemplate the impeccably manicured, rolling farmland, shrouded by a constant, swirling gray drizzle that keeps the fields a robust green and the denizens pale as chalk. Small brown towns, with their distinctive crow-stepped gables, jut abruptly up out of lush pastures. After dark you can go for a walk under the shimmering pinpoint Milky Way and smell the pungent coal fires burning in every hearth.

Kilts and Solder

The average visitor marvels at seeing burly highlanders decked out in all their regalia—the fine wool kilts with swirling pleats, the sporrans and chains slung low over their hips, the daggers in their socks, the soldering irons in

SILICON GLEN

their hands . . . Soldering irons? You heard right. Scotland is not just marmalade and whiskey and bagpipes. Stretching across its narrow lowland waist from the Firth of Clyde to the Firth of Forth is a high-tech belt chockablock with gleaming new factories and thickly populated industrial parks that look as if they were plucked from San Jose or Boston's Route 128.

The roster of companies there reads like the front pages of the *Wall Street Journal*—Honeywell, Hewlett-Packard, Wang, National Semiconductor, Motorola, DEC, Burroughs, and the region's electronics primogenitor, IBM. Twelve of the top 20 American electronics manufacturing firms have plants in the area. The Scots have taken to calling the area "Silicon Glen."

This really shouldn't come as too much of a shock. Scotland boasts one of the finest school systems and best-educated populations in Europe. Few nations have cranked out as many notable scientists and inventors per capita. The government runs a development authority that has a half-billion-dollar annual budget for attracting new business and provides a generous slate of grants, loans, and tax write-offs: you put up \$2 million to start a \$12-million company, and they'll find ways to scrape together the balance. Unions have only a 35-percent hold on the workforce; benefits—and labor costs—are half those of the Continent. And everyone speaks English, sort of.

One of the first major American high-tech firms to settle in Scotland was IBM, which set up shop back in 1951 in an old Battery Park torpedo factory. Ten employees assembled punches, verifiers, and sorters in 7,000 square feet of space. Three years later, a staff 25 times larger moved to its present location at Spango Valley, in Greenock, Renfrewshire, an hour or so west of Glasgow. Today, 2,500 workers and a host of robot body parts ramble around in over a million square feet. Aside from hammering together keyboards and displays, Greenock is responsible for assembling every PC for sale in



Alex Wilson, plant director of IBM's facilities in Greenrock, Scotland.



Workers in the highly automated IBM facility still do some assembly work by hand.

Europe, Africa, and the Middle East.

Giant Vending Machine

The plant boasts what may possibly be the world's largest automated ware-

house—its \$30-million Advanced Materials Distribution Plant, better known to the locals as "the giant vending machine." IBM's AMDS can shuttle 24,000 single-ton skids in and out of their

pigeonholes without any human intervention. Visiting factory managers accustomed to warehouse chaos and personnel problems back home weep when they see the intricate metal organism weave across pallets back and forth in a breathtaking, computerized ballet. IBM set up the distribution center as a separate business unit, and it took 4 years to build. The project officer who sired it is now working in Boca Raton in IBM's Automation and Distribution Competence Center. It took 900 man-months just to write the software that runs it.

Plant Director Alex Wilson, like any proud papa, bursts his buttons showing the thing off. Wilson is a knife-edge cherub from Dundee, home of the three *J*s—Jute, Jam, and Journalism (the Thompson newspaper empire is anchored there). Someone once said that looking into Cornelius Vanderbilt's piercing eyes was like watching a freight train bear down on you. Wilson is as charming as they come, but you get the sense that anyone who crosses him hears that big diesel roar.

Accompanying him through a churning sea of automated machinery, I was transfixed by the sprawling maze of belts, rollers, cams, conveyors, lifts, tracks, sensors, whooshing robotized carts, gates switching and clicking in sequence, servos trailing long twitching cables, jittery humming motors, bouncing curvilinear hydraulic lines—all of it freshly painted, gleaming, chromed, non-unionized.

Way off in the distance a neatly-scrubbed maintenance engineer was tinkering with a set of balky, blue mechanical arms. The only other humans visible were behind a thick, smoked-glass window, eyes glued to their monitors, hands autonomically snaking to softly pulsing lights on shiny switch panels. The effect was magical, otherworldly, a cross between the flight deck of an immense aircraft carrier and the underground control center at Disneyland.

Wilson paused outside what looked like the door to a nuclear reactor, screwed an impish grin onto his face, and asked in

his crisp lowlands burr, "Do ya suffer-r-r fr-r-rom ver-r-r-r-r-tigo?" Hell no, I'm tough as they come; I eat instant-death sudden drops for breakfast. I strode briskly through the portal onto a jiggling wire-mesh grid suspended precariously above a

One of the first major American high-tech firms to settle in Scotland was IBM.

fathomless abyss. Every organ from my knees north instantly knotted into a clove hitch somewhere near my throat. It was exhilarating—if you like raw terror. Not much different from doing one-arm pullups from the roof of the AstroDome, I suspect.

All around us, ten-story-high yellow cranes hurtled along endless aisles extending down long lines of perspective into the gloaming, extracting and depositing single-ton skids of inchoate IBMs like a frenetic shiva-armed postman sorting mail. I peered nervously through the mesh grid at the cement floor far below, and could swear I saw sinister stains where previous journalists with teetering senses of balance had met their maker. White-knuckled panic has a habit of blurring one's perceptions.

A Touch of Boca

The Scottish operation essentially replicated Boca's PC assembly system. However, they don't screw PCs together in the sleek, ultramodern main Spango Valley plant. Instead, IBM renovated an abandoned factory in downtown Greenock and set up Europe's only PC line there. The only part of the American operation the Scottish management didn't replicate was Boca's administration system, preferring their own—you know what people say about highlands frugality. Both plants are tied to other IBM facilities worldwide via

their own 1750 telephone system and IBM's tie-links.

Since 1977, their production lines have had a high degree of mechanization. According to Wilson, "mechanization is just getting the parts in and out. We went along the premise that says if you establish a footprint—and the designer always designs within that footprint—then we don't have to change our production lines."

He's very happy with his PC production. The PC assembly facility fits handily in the 100,000-square-foot space; another hundred thousand or so is available nearby if needed. The plant gets several components from the United States (such as floppy drives—although one Scottish drive maker, Rodine, makes drives for markets in both the United Kingdom and the United States) and the Orient, but it makes an effort to establish a base of supply in Europe.

Wilson would like to add shifts to the production line, but feels there is much employee resistance: "We have to be real careful because the social acceptance of working extra shifts is different from that in the United States. You in America have 24-hour shopping, 24-hour home television—it becomes a sort of way of life. Here people are off the pavement at 9:00 at night."

One thing the employees don't mind is the increasing use of robots. Wilson says he spends a lot of time communicating with the employees so they "understand a high degree of what our current business is and some of the future." All of the robotized applications in use at the factory were developed there. Plant engineers are currently busy automating the keyboard line with robots developed, designed, and manufactured in Scotland. The robots, and parts of the assembly line, are run by PCs shrouded in translucent dust covers. Automation seems to be a hallowed word—they're even "playing around with" an automated printer circuit card assembly line.

According to Wilson, "absolutely

SILICON GLEN

none of the PC's success is attributable to automation. When you look at the PC, it's a reasonably simple box, and we've got hardly any automation in the PC line in comparison with what we've got in this plant. That does not necessarily mean to say that it won't go in the future."

Various outside sources pegged the number of PCs being shipped this year from Scotland at around 100,000. Wilson hinted that he was prepared to increase this number at the drop of a hat. He claims to have up to half a million square feet of available off-site plant space ready if necessary for major projects. The main plant fits comfortably in its 120 acres, and bulldozers are already outside plying the lush turf. Wilson admits he could double the size of the main plant if need be. The biggest problem? Parking lots (or as the Scots refer to them, car parks).

Dirty Tricks?

Wilson claims that his labor and other costs are competitive with those in the United States, and that this—as well as an ingenious ploy of his—played a part in attracting Boca's attention. He spoke at length about snagging the PC account:

"We bid for the PC production. I don't think it's any secret that building PCs wasn't really our mission, but we managed to catch Boca's attention and we convinced them that we had a capability. Our original mission was just displays and controllers. They sent senior managers across here and saw what it was that we were doing. And they liked it.

"Every IBM plant within a continental area is in competition with every other IBM plant for the right to make a particular product. Within 3 months of getting the drawings, we had actually designed our own power supply, had it manufactured, bought all the components, produced all our own cards, and sent back a PC plus quite a number of parts.

"There are at least two and sometimes three plants that we all compete with—there's always a reasonable amount of competition. We don't consider that

we've got a God-given right to exist. Amsterdam and Italy were the two front-runners. Amsterdam didn't go for it; Italy did. But it was basically on the prices that we were able to get into the UK and Europe. Plus the way that we assembled and tested and wrapped it all together—we were better.

"We had made a prototype once

Yellow cranes
hurtled along
endless aisles,
extracting and
depositing single-ton
skids of inchoate
IBMs.

before. The fellow who is now our director had a product that he was showing off and was interested in letting us see, to convince us we should make it. And he brought all of his senior managers up here.

"Ten weeks before that we managed to get the drawings, and we actually made one, and when he was telling us about it we sort of pulled the curtains away from the side of the room and said 'oh, one of those' and a gal came over and demonstrated it to him. We've done that trick twice. I don't know if it would work again.

"But it was quite interesting. In 3 months we went out to vendors and made all our own cards. We had them assembled by other vendors after buying all the components. Someone came in and designed and made the power supply. It shows what you can do when you really set your mind to it. There are a fair sprinkling of vendors in Scotland. The raw cards all come from Scotland. A fair number of the components, all of the metalwork, and all the rest of it come from here. We get some stuff from abroad—Europe. The card is assembled and tested for us by

a company in England and the publications are actually done in Glasgow. We are actually shipping manuals to the United States as well.

"We control the software, but the software is actually copied for us in a French IBM facility. We control the whole of the European chain. Approximately 85 percent of our products are exported to Europe. There are probably more than 600 dealers there."

No Delivery Delays

Wilson is able to meet the European/African/Middle East demand without any problem. He claims he's shipping all his PCs "on time" and admits the wait is far longer in the United States: "I believe that the market there has taken off. Although the UK has possibly got the biggest market for home computers per capita, I think in the professional area—which we believe the PC fits into—the market in the States has grown faster than the market here. They also had a significant advantage in the marketplace when they signed up ComputerLand and Sears."

There are several reasons why computers have scratched out such a toehold in the UK. The first, according to Wilson, is that local computer vendor Sinclair came out with products that were decent beginner's computers and extremely affordable. The other big reason is that the government has made a grant available to place computers—generally BBC Acorns—in every school. There are few IBMs in schools because the PC is so new; the government updates its list of approved computers once a year, and the PC wasn't even really available last time around.

Most of the other micro suppliers in Europe are worried. IBM wasn't even a presence a year or two ago, and now they're methodically displacing the current market leaders. Although the market is very different from that in the United States, IBM PC fever is rapidly spreading eastward across the Atlantic. And Alex Wilson will be only too happy to watch the temperature rise. ■



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Getting A Taste Of The PIE:Writer

Hayden's new PIE:Writer word processor for the IBM PC is not as well baked as their Apple PIE, but it's still a sweet program that goes down pretty smooth.

The program *PIE:Writer* is advertised as the "world's best word processor" having beaten four out of six dedicated word processors in review tests. *PIE:Writer* is indeed a sophisticated and relatively inexpensive word processing system, but these glowing reviews it

PIE:Writer

Hayden Software Company
600 Suffolk St.
Lowell, MA 01833
(617) 953-0200

Price: \$199.95

Requires: 64K RAM (128K for split screen), one disk drive, DOS 1.0, 1.1, or 2.0.

CIRCLE 761 ON READER SERVICE CARD

has received were written for its Apple version, which has gone through two polishings.

PIE:Writer (2.5) for the IBM PC bills itself is easy to use, but it isn't easy as pie. The control commands are more intelligently assigned than those of, say, *Word-Star*, but there are 184 different commands in all. In case your machine doesn't have separate function, tab, or cursor control keys, an additional 60 alternate commands are given. And though the control key/letter combinations are discussed at length in the manual, the alternate function, tab, and cursor keys are often mentioned only once. The diskette does include a lengthy tutorial and a couple of short files to practice on, but there is only

one help screen, which presents only the simplest functions and commands.

The Manual

The manual (which includes four pages of errata) provides good lessons on the basic procedures for editing and formatting text. The chapter on how to configure the editing and formatting programs is short and sweet. It explains how to change default settings on the usual default, plus such things as values for tab increments, text entry mode, baud rate for serial printer, line feed after return, underline method (none, backspace, overlay, or start/stop), certain control characters, header/footer and page top and bottom margins, paragraph indentation (up to 127 characters),

PIE:WRITER

and paragraph spacing.

A well-organized reference chapter provides a complete rundown on the 184 commands. An "Advanced Topics" chapter details use of the mail merge feature, which inserts various information (dates, names, and so forth) into standard documents so you can easily grind out form letters or complex mailing labels. The Terminal Communications program is also briefly described. This software is included on the *PIE:Writer* diskette supporting asynchronous telecommunications between two *PIE:Writer*-equipped computers. It works with a Hayes Micromodem II or an RS-232 serial controller card plus acoustic coupler (the IBM Communications Card or CCS7710A Serial plus Novation CAT coupler).

The manual concludes with an extensive index to both command functions and the commands themselves, but this has more than a few errors that are not corrected in the errata list. It also has some curious lapses. For instance, it fails to tell you how to accomplish justification and how to delete a line.

I installed *PIE:Writer* on my IBM PC with 128K RAM and an 80-column color monitor. I was informed via the manual that certain files used for configuration are deleted automatically once *PIE:Writer* is installed. For all its many features, the *PIE:Writer* original diskette has only 148,480 bytes on it—quite a powerful *little* package that is slimmed down further after configuration.

After I began working with it, I found *PIE:Writer* to be an amazing piece of software. You type in text plus formatting commands on a 127-character-wide editing screen (you can see 78 columns at a time with automatic screen shift to the right) and 22 lines deep. Tab stops and margin indicators are given along the top of the screen. The status line at the bottom indicates the column and line location of the cursor; overwrite or insert mode; word wrap, manual, or autoindent modes; argument indication (for escape-key command sequences); and name of file. When you

finish editing text, you come to a formatting menu. The text may now be sent directly to a printer or to the monitor screen to preview layout, design, and printing of the document (while obeying

The manual has more than a few errors and some curious lapses.

the non-printing formatting commands). The text is shown in actual page layout, page by page.

Full Featured

PIE-Writer has all the basic features of most word processing systems. Some commands are single key (E, for example), some double (or triple) key (Ctrl/A), and many are sequential (Esc W Enter).

You can easily move the cursor to any particular column by pressing the Esc key plus a number. Hitting the tab key with the shift key moves the cursor to the left. Setting and clearing individual or multiple tables is easier than on a typewriter. You can advance or reverse one screen at a time or by 1/3 of a screen, or you can skip a specified number of screens. If you have at least 128K RAM, you can edit two files at once with a split screen. The two screens can be varied in size, or two files can be edited alternately on a full screen.

Delete and insert functions are standard. The cursor is just a big pulsing rectangle, and the word "insert" on the status line tells when you are in the insert mode. You can also split a line at the cursor and move the text on the right of the cursor to the left margin of a new line. You can call for the insertion of any number of blank lines at the cursor. All characters from the cursor to a particular letter in a line can be deleted. It doesn't matter where in a word the cursor is when deleting it. You can insert the date or file name at the cursor by using only two key strokes.

Search and replace functions are powerful in *PIE:Writer*. You can specify forward or backward searches for a string of up to 58 characters, with a wildcard character thrown in for flexibility. Replacement of strings is one by one or global.

There is extensive use of cursor-defined commands: two different positions of the cursor provide the upper left and lower right corners of a rectangle of area on the monitor to be modified. Text or space may be inserted or deleted, and you may save this block to a side file.

Control characters (nonprinting characters such as imbedded printer commands) can be inserted with a control/backslash key combination. The control character will then be displayed in inverse video. Nonstandard ASCII characters are entered with the Alt key and ASCII number.

Certain auxiliary commands give you directory, space on disk, file status, word count, or line count information and let you save or load tab settings, set high bit, set/reset line feeds after carriage enter, and delete or rename files. The function keys are used for some of the common commands, divided about equally between editing (such as delete a word or line and store it in memory) and formatting instructions (center a line or begin a new paragraph).

Editing

The editing facility contains three modes of text entry. Manual mode, the default, is typewriterlike, giving you a beep when your line passes the bell-column, at which time you press the Enter key to start the next line. The PPWrap mode is word wrap, automatically beginning a new line when your text line reaches the right margin marker. (The tab key in word wrap mode stops the cursor at the first letter of each word, not at the tab stops as in the manual mode.) The autoindent mode is like the word wrap mode but begins a new line directly under the first letter of the last line, producing the hanging indentations necessary for bibliographic work.

PIE:WRITER

PIE:Writer files may be up to 65,535 lines long, about 1,300 pages. When you edit a previously created file, you automatically produce a new file with the old one saved as a backup with the file extension .BAK. *PIE:Writer* does not copy the newly edited file over the old one; it copies the new backup file over the old backup file.

PIE:Writer moves an edit buffer across your file, which can be very large depending on your system's memory. Since editing is not page-oriented, you can move through the file very fast, either screen by screen or by specifying the screen line you want. Some memory is also allocated to a copy buffer to store lines or blocks of lines and to reintroduce them into the text later. *PIE:Writer* can also read from or write to side files from the file being edited. The side files can be used for storing large inserts.

Formatting

The formatting program of *PIE:Writer* is particularly effective, and I will just touch on a few of the most interesting features. Formatting is accomplished with 49 different nonprinting dot commands, each one entered beginning on the left of its own, separate line. For instance, .AD gives right margin justification and .NA cancels it. .CE 3 centers the next three lines, .LS 2 produces double spacing, .IN followed by a number indents all following text that number of spaces, and so on. Dot commands requiring numerical parameters have default values, so you don't have to keep tacking in numbers.

Files are easily chained. This can be used to set up standard formats (such as a file of dot commands for formatting) or for labels, letters, and office documents. Files also may be queued, which prints the files sequentially with each file beginning on a new page.

Dot commands are available to control such paragraph parameters as space between paragraphs, temporary additional indentations, number of lines needed to begin a paragraph (eliminates widow lines

Easy As ABC

In the spelling software bee, Hayden's *The Speller* gets an A and moves to the head of the class.

P*IE:Writer* may not be as easy as pie, but there's no doubt that Hayden's spelling checker program, *The Speller*, is a real peach. It's one of the cheapest spelling checkers on the market, and it gives fast, easy, and accurate service. It's even designed to merge with *PIE:Writer* so that both systems fit on one double-sided double-density diskette. *The Speller* is then accessible directly from *PIE:Writer*'s main menu (with 128K RAM). *The Speller* can also be used separately, configured for use with word processors such as *Easy Writer 1.1*, *FinalWord*, *Volkswriter*, *WordStar*, and an "other" category.

The main dictionary of *The Speller* is not a hash of stems, suffixes, and prefixes. It contains 20,575 words compressed with a unique algorithm that speeds the look-up routine. *The Speller* first compares your text with a list of the 1,200 most common English words, loaded in memory. Then, words in your text that do not match these are checked against the main dictionary and against a personal word list you devise yourself.

The master menu then offers several options. The valid words, suspect words, or corrected words can be displayed as summary lists, either on screen or as a printout. You can check each word individually and either accept it as

is, accept it and save it to a dictionary, replace it with the correct spelling, or postpone action. The Scan function is impressive. Your text is scrolled on the monitor, stopping at a highlighted suspect word, which is dealt with in the same way that words are checked individually. Banging the space bar once will approve the suspect word, save it to a dictionary, and scroll text to the next suspect word. You can also go over the suspect words with any number of added special dictionaries. A review function lets you look at previous choices and change your mind. You can interrupt any of these commands and return to the main menu at any time.

Rather than just marking words for later correction with a word processor, *The Speller* creates a new file (with the old one's name) that has your spelling changes in it, and renames the original uncorrected file with the extension .BAK for use as a backup. (You can mark words if you want to.)

The Speller's dictionary is relatively small and cannot be added to. There is no compression facility for the additional dictionaries in ASCII that you create yourself. You can, however, buy replacement system dictionaries featuring specialized vocabularies for the legal and other professions from Hayden Software (call (800) 343-1218 for information). The manual cautions you not to accept misspelled words for the side dictionaries, but the ASCII supplemental word lists can be periodically reviewed and corrected with a word processor.

I'm going to use *The Speller*. It is well worth the \$49.95, and Hayden Software has a winner with this one. —R.Z.

The Speller

Hayden Software Company
600 Suffolk St.
Lowell, MA 01853
(617) 953-0200

Price: \$49.95

Requires: 64K RAM, one disk drive.

CIRCLE 758 ON READER SERVICE CARD

PIE:WRITER

at the bottom of the page), and paragraph indentation. Layout commands include justification control (allowing incremental justification if your printer will support it),

line spacing, space down a number of lines, force a number of blanks, page length, and begin new page.

Format instructions for running titles

(headers, footers) and top and bottom margins are well worked out. Pagination is automatic. Through dot commands, *PIE:Writer* can center, boldface, underline, and capitalize text anywhere on the page. Blocks of text from separate files can be inserted in various places in a standard document. STOP dot commands halt text printing so you can change ribbon color or the daisy wheel. There are broad formatting limits: maximum page length is 250 lines, maximum number of pages is 999, and maximum output line length is 132 characters.

What doesn't *PIE:Writer* do? There is no provision for footnoting. *PIE:Writer* doesn't support a mouse. There is no UNDO command. On-screen help is limited. There is no option for two-column justified text. The headers can't be shifted alternately right and left for book formats. There is no automatic index generation. And it won't fetch the morning newspaper or pour your orange juice.

There were also two outstanding bugs in the system I reviewed, which Hayden has since corrected. In order to get the program to configure itself, it asked for a non-existent file called "date.com" from my PC-DOS. Additionally, I couldn't make the reconfiguration file change the default right margin from column 65 to any column other than one to 24.

In fairness, Hayden Software claims to have an upgrade policy for owners of early-issue IBM PC *PIE:Writers*. A bug-free version can be obtained by mailing in the original *PIE:Writer* diskette. Owners should call (800) 343-1218 for a return OK and have the serial number handy.

I found that 184 commands are a lot to keep in your head at all times, so perhaps *PIE:Writer* is not for the hack software reviewer. It is, however, just right for those office text-architects who need the greatest flexibility in editing and formatting a variety of documents. If you are willing to wed your psyche to the 184 *PIE:Writer* commands, you can have your very own quasi-dedicated word processor on the IBM PC for less than \$200. ■

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PC-Write

Quicksoft

219 First Ave. N. #224

Seattle, WA 98109

(206) 282-0452

Price: \$10 for diskette; \$75 to register.

Requires: 64K RAM, one disk drive.

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PC-Write, from Quicksoft, of Seattle, Washington, is available under a unique distribution plan called Shareware (or Freeware). Like other programs that employ this marketing method (such as the communications program *PC-Talk III* and the file management program *PC-File*), *PC-Write* still manages to generate some income for its company. It includes a notice that users are permitted, even encouraged, to allow others to copy the diskette, which is how most users obtain their copies. (The program is also available from the manufacturer for \$10.) One of the files on the diskette includes the full text of the nearly 100-page manual. Bob

Wallace, the author of the program, suggests that satisfied users register their use of the program and make a contribution of \$75. The benefits of doing so are impressive. You'll receive a bound, printed copy of the manual, a copy of the latest update of the program, the Pascal (MS-DOS) and Assembler source code for the program, and a \$25 commission whenever another user registers a copy derived from your original program.

Even at \$75, *PC-Write* is considerably cheaper than most other available word processors for the PC. But you don't buy a word processor simply for its price, but because it can help make editing and text

HONOR SYSTEM

entry quick and easy. Other criteria are speed, reliability, and the various features it offers. On this bottom line, *PC-Write* rates extremely well and compares favorably with many word processors costing much more.

You can enter text in *PC-Write* in either of two modes: Pushright (often called the insert mode by other programs), and Overwrite. When you enter text, it pushes the text ahead of it forward, rather than typing over it. In Overwrite mode the text you type replaces the text currently at the cursor position. You switch modes by pressing the Scroll Lock key at the upper right corner of the keyboard. All of the cursor controls and other commands remain available in either mode.

Key Assignments

PC-Write was designed specifically for the PC and makes effective use of the entire keyboard. The function keys and the keys on the numeric keypad are all effectively used to provide single-keystroke access to a wide variety of editing, cursor, and screen-movement commands. All the keys have alternate functions assigned to them when they are simultaneously pressed with the Shift key. Some have additional functions when pressed in conjunction with the control key.

Most of the keys are used to move the cursor or scroll the screen. The four arrow keys move the cursor logically, one step at a time. The Home key moves the cursor to the left end of a line, the End key, to the end of the text on a line, and the PgUp and PgDn keys scroll the screen one line at a time. Pressing certain keys in conjunction with the Shift or Ctrl key will accelerate their effects. For example, the shifted PgUp and PgDn keys scroll the screen a page at a time, and the shifted up and down arrows will take you to the top or bottom of your screen. Other combinations allow you to move the cursor forward or backward one word or paragraph at a time. The latter is an unusual, valuable feature.

If you press Ctrl-Home, *PC-Write* sets

a marker, called a bookmark, at the current cursor position. You may return to that marker by pressing Ctrl-End.

The program numbers the lines in your file. You can find the number of the cur-

When you want to
transpose two letters
PC-Write can do so
in a single
keystroke.

rent line by hitting Shift-F9, and you can jump directly to any line by entering its line number after the Shift-F9 combination. You can use single keystrokes to delete single letters, words, or lines. *PC-Write* keeps the most recently deleted word, line, or block in a buffer, and allows you to recall it and undo your deletion with a single keystroke.

You can mark text with *PC-Write* and move, copy, delete, or save it to a file. Single words and lines can be marked with a single keystroke, and blocks of text can be marked using F6.

When you use *PC-Write*'s powerful arsenal of cursor movement controls in conjunction with its marking capability, you are able to perform complex editing tasks quickly and easily. For example, to move a paragraph, you position the cursor at the beginning of the paragraph, hit F6 to start marking, Ctrl-PgDn to move to the start of the next paragraph, and F6 again to end marking. Next, you move the cursor to the new location hit the F4 key to move the paragraph—a simple operation.

PC-Write includes an unusual number of little extras—commands that are extremely useful but are often overlooked. Pressing the F8 key changes the letter or cursor position from upper to lowercase (or vice versa). Most other word processors require you to either delete the current letter and retype it, or switch to an overwrite mode. When you want to transpose two letters *PC-Write* can do so in a single

keystroke. It also allows you to split the screen into windows.

Although learning the key assignments takes time, *PC-Write*'s intelligent design facilitates the learning process. Pressing F1 displays a help screen that summarizes commands and features. And *PC-Write* has an additional design feature: Any of its commands may be assigned to any control key combination. If you're used to a program that uses control keys for commands, you can set up *PC-Write* to operate that way and mimic your favorite word processor. Unless you alter them, the control key commands are set to correspond to those used by *WordStar*.

Better than WordStar

Before I acquired *PC-Write*, I'd been doing most of my writing on *WordStar* and, as a result, I found *PC-Write*'s approach to string searches and search-and-replace operations took some getting used to. But, after some practice, I am delighted with *PC-Write*. Each time you perform a search on *WordStar*, it prompts you for the name of the string. To perform a search-and-replace, it also asks you to enter the replacement string. *PC-Write*, however, always maintains a current search string and a current replacement string. You don't need to re-enter until you want to change them.

Once the current search string is set you need only press the plus (+) or minus (-) keys on the numeric keypad to search for the next occurrence of the string, forward or backward, respectively. Press F10 to perform a search-and-replace operation. The shifted F10 key lets you undo the last replacement. You can use the Esc key for emergency exits.

When you're editing text that requires moving rapidly from sentence to sentence (as opposed to line to line), *PC-Write*'s method of organizing its searches comes in handy. You instruct the current search string to look for a period (.). Pressing the plus (+) key will then advance the cursor to the end of the current sentence and pressing the minus (-) key will move it

HONOR SYSTEM

back to the end of the last sentence. You can easily mark entire sentences this way, and then move, copy, or delete them quickly and easily, though be aware of sentences ending in exclamation points or question marks.

The use of color is so effective that I use my color graphics monitor.

PC-Write allows you to use three different "wild card" characters in your search-and-replace strings. One will match any letter or digit, another matches anything except a letter or digit, and the last will match any character, whatever it may be.

Your search and replace strings can include line-end characters so you can search for a particular arrangement of words across a line boundary. You can even switch from single to double spacing by replacing every line-end character with two line-end characters.

PC-Write performs all of its functions with unusual speed. When you scroll pages up or down, the new page appears instantaneously. The program jumps from the beginning of the text buffer to the end of the text in a second, even when editing a 60K file. By contrast, *WordStar* takes nearly ten seconds to do the same thing, and *MultiMate* (widely lauded for its speed) takes more than three seconds. *PC-Write* replaced every occurrence of the word *the* with the character "xxxx" in a 25K text, in 57 seconds. The new version of *WordStar* took more than 2½ minutes, and the task took *MultiMate* more than 8 minutes.

Division of Labor

PC-Write divides the editing and print formatting aspects of word processing between two separate programs: an editor program, called *ed.exe*, and a printing program, called *pr.exe*. This division is

somewhat unusual, since the printing program is concerned only with the page-oriented formatting of the final printed text, that is, number of lines per page, header and footer placement, page numbering, and so on. The actual formatting of text within prescribed margins, as well as right justification, are left to the editor program.

You set margins within the editor program by displaying and altering a "ruler line." The ruler line may be saved to and reloaded from the disk. Once the margins are set, *PC-Write* provides word wrap within the margins and returns the cursor to the left margin as set. You reformat a paragraph within set margins by pressing the F7 key. You may direct *PC-Write* to reformat paragraphs with or without right justification. *PC-Write* will not, however, right justify your text as you enter it.

Using the print program, you can put headers and footers on your text, control the number of lines per page, change the line spacing, and number the pages. You may have as many as four header and footer lines on each page, and you can have different headers and footers on right- and left-hand pages. The print program also allows you to merge text from separate files and to incorporate text entered at the keyboard. It does not, however, provide a form letter capability.

Writing in Color

No account of *PC-Write*'s features would be complete without a description of its use of color. If you have a color monitor capable of displaying 80 columns, this program can display text in color and use different colors to highlight marked text. You can even select the colors yourself. The use of color is so effective that I often use my color graphics monitor to edit with *PC-Write*, despite the superior resolution of a monochrome monitor.

Although its editing design, capabilities, and features compare favorably with many of the more expensive word processors for the PC, and its speed is exception-

al, *PC-Write* is still a young product. It lacks some highly desirable features and suffers from a bug or two. Its author, Wallace, is clearly committed to developing the product to full maturity and is even prepared to fix the bugs and supply new features. The one bug I found in version 1.2, for example, was fixed and is no longer apparent in this version 1.3.

One important omission in *PC-Write* is support for special printer features such as boldfacing and underlining. To get these features you can embed any ASCII control characters in your text but Wallace promises to eventually include special printer support. Another feature that I'd like to see in *PC-Write* is the ability to define keyboard macros, so that a single keystroke can be used to generate a sequence of keystrokes. This would simply be an extension of *PC-Write*'s current ability to allow user definition of control keys and will undoubtedly be included in later releases.

The availability of source code to registered users opens a channel for developing these features independently. The source code that Quicksort supplies is complete and well documented. Much of it is in Assembler and takes some time to go through, but diligent hackers will manage. I've already upgraded the printing program to allow a little more flexibility in header specifications, and I expect to do more custom tailoring. It seems likely that users of *PC-Write* will generate numerous updates of the program.

Over the years I've had access to a wide variety of excellent word processing packages. I've been using *PC-Write* for the last month, and it has become my word processor of choice. The performance is superb, the price is right, and the possibilities for customization are fantastic. It's truly worth a try. ■

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The Unfinished Word

If it weren't for its myriad flaws, Microsoft's powerful, mouse-driven Word just might displace WordStar as the premier word processing program.

The mountain called Microsoft has labored long and brought forth, you guessed it—a mouse. To give its plastic rodent its proper place in the overall scheme of things, Microsoft has also brought forth a word processor called *Word*. Even though this is supposed to be a definitive review of *Word*, there's no way *anybody* could give it a definitive

Microsoft Word

Microsoft Corporation
10700 Northrup Way
Bellevue, WA 98004
(206) 828-8080

List Price: \$375 (\$475 with Microsoft mouse and controller card)

Requires: 128K RAM, one disk drive.

CIRCLE 715 ON READER SERVICE CARD

review on the basis of a mere week's experience. I've run into weird word processors before, but this is the first time one's nearly knocked me down for the count.

Word is an absolute original—so original, in fact, that I can't entirely decide how much I like it. *Word* is so chockablock with nifty features, snazzy capabilities, and infuriating omissions that I haven't even begun to discover them all. For good *and* ill, this program works like nothing else I have ever seen.

What's different about *Word*? For one thing, its mouse, but that's just for openers. *Word* offers the closest thing yet to a true onscreen picture of your text, print-formatting options sophisticated enough to drive a typesetting machine, windowing options that can let you look at as many as

eight documents at once, a gratuitous two-keystroke entry of boilerplate paragraphs, and the simplest method of automatic footnoting I've ever seen.

What's wrong with *Word*? There are a host of niggling little irritations and omissions, maddening inconsistencies, the slowest saves-to-disk in the history of mankind, and documentation apparently produced by Madame Sadie's Pain Palace.

You Get What You See—Honest!

In the what-you-see-is-what-you-get sweepstakes, *Word* wins hands down. The program shows you boldfacing, italics, underlining, double-underlining, strike-through type, small capitals, and even superscripting and subscripting right up

there on your screen—if your screen happens to be an 80-column color monitor and you choose to run *Word* in white-on-black (see Figure 1). It's very impressive, but don't get carried away with your newfound power and try too many attributes at once—say, small-capital superscripted

Word automatically reforms paragraphs on the screen as you type. That's mostly a blessing, but it's not entirely unmixed. Delete enough of a long word at the beginning of a line, and the rest is likely to hop back to the end of the previous line. Insert material at the beginning of a

let the keyboard buffer chirp to inform you that you're losing characters.

Using a disk emulator for *Word*'s program files (and the temporary files the program creates) would help speed things up. Though the manual claims you can do this using the DOS 2.0 Path command, it's not true unless you've got a hard disk system, in which case you probably wouldn't bother. (Why Microsoft can't figure out how to make its own DOS Path command work is an interesting question. The answer seems to lie in the fact that *Word* has been copy-protected with a scheme designed to promote regular use of oaths and imprecations normally saved for very special occasions.)

Word comes on two disks, and you need both to run it. Disk 2, the "program" disk, can be copied without limitation. But disk 1, the "system" disk, may be copied only twice: once to another floppy and once to a hard disk. With floppy drives you must insert the system disk in drive A to invoke *Word*. After about 12 seconds, you then respond to an onscreen prompt by removing the system disk, inserting the program disk, and hitting the Enter key (which, perversely, Microsoft insists on calling RETURN). After another wait, you're ready to begin editing.

Since the whole process takes a good long while, you'll think thrice before exiting to DOS and having to go through the process all over again. Inevitably, you stick the program disk in the drive instead of the system disk, or the system disk mysteriously takes a brief vacation from your desk. Hard-disk users are apparently spared these woes and should enjoy a marked increase in speed as well.

But the idea of a copy-protected word processor is anathema to anyone who has to depend on the software for a living. What if your one diskette copy goes onto a bad disk? What if you have to reformat your hard disk for some reason or other? Sure, of course you can use the original system disk and order a replacement copy for a mere 25 bucks, but just how long will you be out of business if the system disk

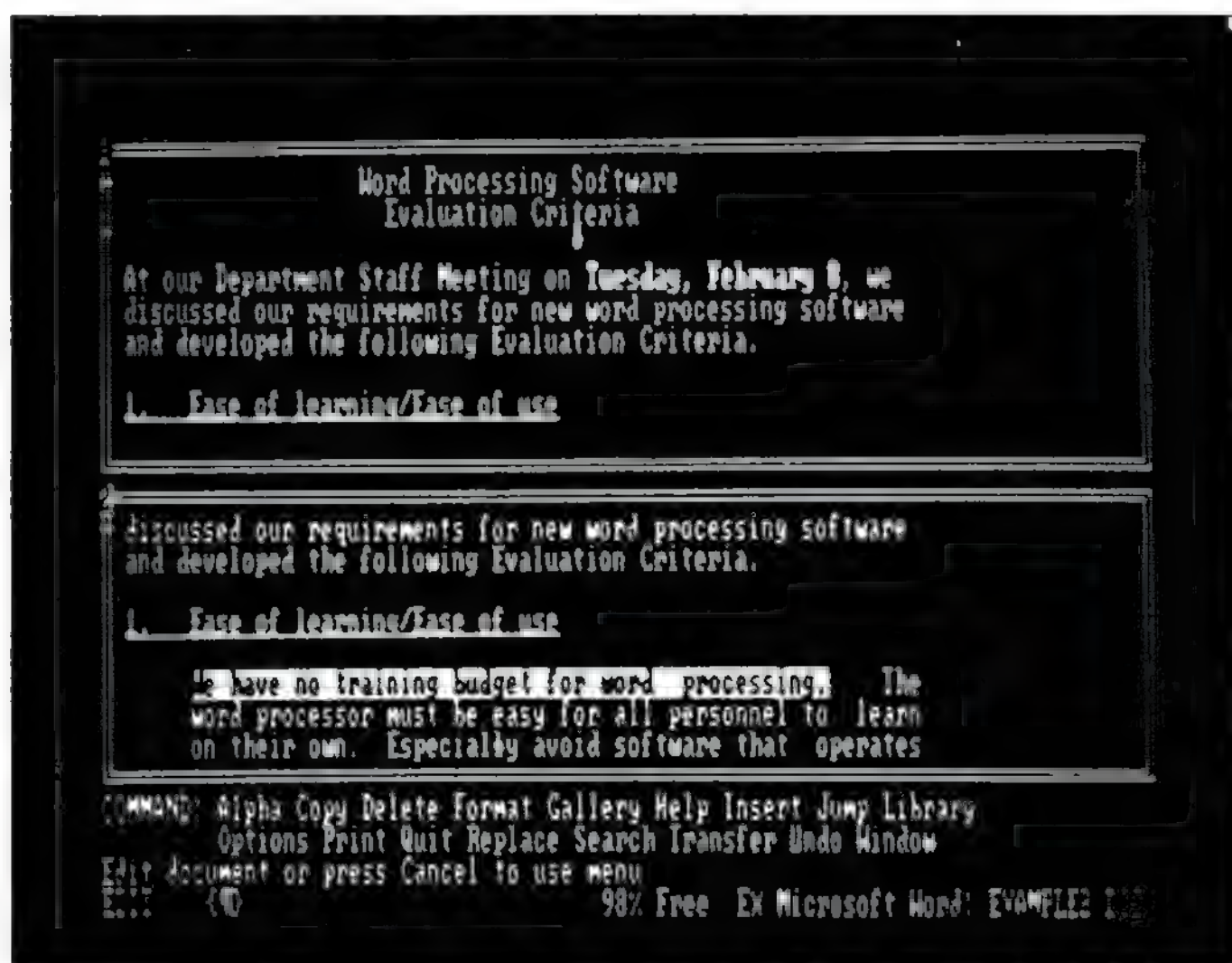


Figure 1: Among its many on-screen features, *Word* can display bold italic type (the heading), bold type (the date), and underlining.

italics. You just may find the characters illegible or partially missing.

If it's hues you want, you can run the program in peacock mode and choose among eight background colors, to the detriment of what-you-see-is-what-you-getness. *Word* picks the foreground text colors for you: usually white for normal characters, high-intensity white for boldfacing, and green for all other character attributes. Monochromers do okay, too: underlining and boldface show up that way on the green screen; other attributes are underlined. One irksome problem in both these modes is that without printing the document, it's impossible to tell whether a character has truly been underlined or has actually received an attribute like superscripting—or both.

paragraph, and the screen will stay distractingly busy keeping the rest of the paragraph neat and pretty. Work with right-justified text, and you'll find a lot of your typing scooting from right to left on the screen. Fortunately, getting your current keystrokes up there on the screen is *Word*'s first priority, so you're rarely flying blind.

The Two-Disk Shuffle

Unfortunately, "rarely" does not mean "never." Fast as it is in many of its functions, *Word* does have its slow points. While it's performing one of its periodic disk accesses for housekeeping, you won't see your keystrokes. Usually the screen will catch up with you after a keystroke or two, but *Word* can go dead long enough to

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fails before that replacement arrives?

The Gumby Cursor

Word offers lots of ways to move the cursor—except it doesn't admit to having a cursor. Oh, the cursor's *there*, all right, but it's so bizarre that Microsoft has chosen to call it the *selection*. Like a cousin of Gumby, the crazy cursor can stretch from its normal one-character size to encompass entire sentences, paragraphs, or a whole document.

When it comes to moving the cursor—sorry, “selection”—the direction keys on the keypad do pretty much what you'd expect. Ctrl-PgUp and Ctrl-PgDn take you to the beginning and end of your document, respectively. But Home and End take you only to the left and right ends of lines, and there's no quick way to get to the top or bottom of the screen. Response to the PgDn and PgUp keys is often sluggish, and, unlike *WordStar*, *Word* will not let you hit a Pg key, say, five times and get you to where you want to go without having to look at all five intermediate pages. In fact, if you hit a Pg key five times in rapid succession, *Word* will generally flip through two or three pages and quit.

But when you press the “Word Left” (F7) or “Word Right” (F8) keys, the cursor doesn't simply *move* in the indicated direction, it also *expands* to highlight—“select”—the entire word. The F9 key “select”—the entire word. The F9 key selects the current sentence. Shift-F7 and Shift-F8 select the previous and next sentences, respectively. F10 selects the current paragraph. Shift-F10 selects the entire odd-size hunk of text, hit F5, the Extend key, and any combination of cursor-moving keys, and the selection continues from where you started selecting to where you stop, in either direction.

The selection process can be fraught with confusion, since some keys select *and* move the highlighting, whereas others only select. Furthermore, *Word* may have different ideas than you about what constitutes a sentence, a paragraph, or a word. And depending on whether or not the

Extend mode is in effect, a single left or right arrow may move you somewhere you didn't want to go.

Selection is absolutely vital, however, because it's part one of the Microsoft two-step, which you must dance to do almost anything within *Word*. Want to delete a word? First select the word, then press the Del key. Same thing for a line, sentence, paragraph, you name it. Want to underline some important stuff? Select it, hit Alt-u, and voilà! Still, even the simplest deletion of more than one character is a two-step process. The lack of an easy way to mark and delete “the rest of” a word or line is a serious omission.

Another annoyance is the way the program sends the active typing area almost all the way to the top of the screen when you reach the right end of the bottom line. This idiocy, fast becoming a commonplace in word processing programs, is one of the little mysteries of the computer age. What earthly good do program designers believe you get from seeing a blank screen rather than being able to review the text you've just typed?

Undo That Again!

The backspace key acts destructively and, on random occasions, exceptionally slowly. Use it to delete text, and that text is gone for good. In overwrite mode, selected by the F5 key, the backspace key doesn't do anything at all, except now and then when it stretches the selection backwards. (This behavior is utterly undocumented by the manual.)

Shift-Del kills the selection permanently. The unshifted Del key deletes the selection to a buffer called the “scrap.” The Ins key sticks the scrap into your text at the selection position.

If you're used to deleting text by holding down the Del key and sucking up text letter by letter, get used to doing something else. With this particular operation, and only this one, *Word* updates the scrap contents indicator at the bottom of the screen (line 25) before updating the text. Even if you keep your eye on the letters

spinning by on line 25, you're bound to delete more or less copy than you'd intended.

The advantage of the scrap is that you can “undelete” your mistaken deletes if you catch them quickly. Esc-u will undo your last “edit.” In general, that means it will restore your text to the state prior to your most recent deletion, but I've been surprised on many occasions by what *Word* actually undid, including the insertion of underlining that wasn't in the document in the first place. If you change your mind before making any changes in the text, *Word* can undo an undo.

But remember: the removal of even a single character with the Del key will change the contents of the scrap. You can undo the Del sequence and then yank the scrap back into your text with the Ins key. But *two* deletions, no matter how small they are, trash the prior contents of the scrap forever.

Block moves, the writer's greatest friend, are therefore handled in a way that is, alas, increasingly becoming standard. To move a block of text, you select and delete it to the scrap. Then you move the selection to the proper point and insert the block. It sounds okay, but it forces you to make the move immediately. If you get to the destination point and discover you want to make some changes in the text, you have to wait until you've moved the block first. If you accidentally make more than a single deletion before you put the block where it should go—as I guarantee you will when your phone rings immediately after you have deleted the block—your text is gone forever.

WordStar's method—simply mark the beginning and end of the block, then do anything you choose until you're ready to move it—remains far more flexible and straightforward. And *Word*, incidentally, does not permit *WordStar*'s useful column block moves. Nor does it permit *WordStar*'s handy command that takes you back to where the moved block came from and lets you inspect what's happened to the old neighborhood.

Enter the Rodent

For those of you who have been away from the planet for the past year or so, a mouse is a palm-sized hunk of plastic that rolls across your desktop on metal bearings and has two buttons that fit neatly beneath the fingers. As implemented here, it has its very own onscreen cursor, or, in Microsoft's cursorless jargon, *pointer*. In the high-resolution color-card version, the pointer is a jaunty arrow pointing at a rakish angle. In the other versions, the pointer's a small blinking box, vaguely distinguished from the tall unblinking box of the selection. Roll the mouse forward, back, or sideways and the pointer moves up, down, or across the screen.

With *Word*, the mouse can do just about anything the keyboard can except enter text, and it can even perform a few special tricks the keyboard isn't up to. To select text, for example, you position the pointer over the section in question. Clicking the left button—pushing and releasing it—selects the character at the pointer position. Clicking the right button selects the word beneath the pointer. And clicking both buttons selects a whole sentence.

But if that still doesn't click with your needs, you can hold down one or both buttons and pull or push the pointer through your text. When you let go, you'll have selected everything from where you started to where you stopped—much as if you'd used the Extend and cursor keys.

Still not enough for you? Then get the pointer into the "selection bar," which is the empty column directly to the left of the text. If you're using the high-resolution screen, the pointer will change direction, but even on the monochrome screen, where the pointer never changes shape, you'll discover a whole new mouse. Click left to select the line immediately to the right of the pointer; click right to select the neighboring paragraph. Click both to select the whole document.

And that, as they say in late-night television commercials, is not all. Move the mouse onto the left-hand border—the "scroll bar"—and the pointer changes

into a double-headed arrow. Click left and the top line of the screen scrolls down to the level of the pointer; click right, and the line where the pointer is resting scrolls up to the top of the screen. Click both—well, now, here's one of those mouse-only functions, the "thumb."

Thumb Fun

For no good reason, *Word* provides no real clues as to how much text you've entered—not so much as a hint about how many characters, words, or lines you've got in your document. The only page breaks you can display are those of the most recent printing; page numbers do not display at all. There's a way to jump between pages, but if you haven't yet printed or repaginated the text—and repagination is excruciatingly slow—*Word* thinks it's all one big page.

Word keeps track of how far along you are in your text via a "thumb"—a marker displayed in the scroll bar. If you put the mouse pointer about a third of the way down the scroll bar and click both mouse buttons, *Word* moves the thumb to the pointer position and moves you to a point in your text about a third of the way from the beginning.

Sounds great, but in practice it's not. Since the thumb has to appear on a line, there are only 19 possible thumb points in the very largest window you can display on your screen, no matter how large the document. In a four-line window, there are only four. But it's still better than trying to get around with the keyboard's uncooperative Pg keys.

There's another catch when scrolling with the mouse. The mouse moves the text, but it doesn't move the selection. This means you can end up staring at a screen that contains nothing even remotely resembling a cursor. If you want the selection to appear in the text on display, you must move the pointer into the text and click a mouse button. Otherwise, the moment you touch a key, you will instantly be transported back to the selection whence you came. It's confusing as all

getout, but once you get the hang of it (something I have not managed to do), it could be useful for examining text at sizable distances from the selection.

Otherwise, navigation through a long stretch of text is extraordinarily difficult. Unlike *WordStar*, *Word* offers no easy way to set place markers. Once you've left a spot in the middle of the text, finding it again can be a chore.

The (25-6=19)-line Screen

On the bottom line of the screen, like *VisiWord* and many spreadsheets, *Word* displays the following status information at all times: what editing mode you're in; the first and last few characters of the "scrap;" a question mark that can be used to call up a help screen; an indication of how much room you have left for your document; the status of the Caps Lock, Scroll Lock, Num Lock, and overtype toggles (though only one is displayed on the screen no matter how many are currently in effect); the name of the program, in case you forget; and the name of the document you're editing. The line above the status line displays messages and mash notes from the program. The next two lines above are reserved for the Command menu. The line above the command line and the top line of the screen are given over to borders.

Thus, as far as text entry is concerned, your big 25-line screen has miraculously been transmogrified into a puny 19-liner, and there's not a thing you can do about it. It gets worse when you use more than one window. My guess is that *Word's* next release will feature *WordStar*-style "pop-up" menus that go away until you ask for them. Anyway, it ought to.

Unlike *WordStar* and other programs that let you enter text or commands at almost any stage, *Word* is "mode-oriented." To do anything much fancier than simple text insertion and deletion, you must escape from the text entry mode (here called Alpha) and enter the Command mode. Then you select from the Command menu and its submenus.

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To use the menus with the mouse, all you do is point and click. The left button gets you the option you're pointing to; hitting both buttons cancels the command. The right button gets you not only the option you're pointing to, but also the default from the next submenu. Until you learn what those submenu defaults are, this option can be dangerous. Often clicking the right button will get you an action precisely the opposite of what you wanted. You have been warned.

From the keyboard, it's the Esc key that gets you into the Command menu. Once there, you can select an option by pressing its first letter. Or you can move the highlighted selection forward and backward through the menu—but not by using the eminently logical arrow keys. The approved keys for cursor movement here are Tab and Backtab, but the Space and Backspace keys will work, too.

These keys won't work in submenus when "Command Fields" are to be filled in, and in general, neither will single key-presses. The only way to move through a menu that presents a series of multiple-choice options is to use the Tab and Backtab keys, since the space bar and Backspace key will move you forward and back through the choices for each individual option. The accursed arrow keys generally get you an audible raspberry. Exceptions are the occasions when they can be used to increment and decrement numbers or, defying all reason, to get a directory of the current disk.

The menu setup is remarkable primarily for its confusion and inconsistency. The main-menu commands are listed alphabetically; in the submenus, the default is always the leftmost choice, but the other choices are in no particular order.

My personal pet peeve is that when you cancel a command with the Esc key, you have to hit the Enter key or A for Alpha to return your text. But since you can move the text selection (I nearly wrote "cursor") with the arrow keys and even use the Del key while you're still in the Command menu, it's easy to believe you're back in

Alpha mode when you're not. How many times have I hit several letters after canceling a command and then discovered *Word* interpreting them as commands to the point of near-disaster? Don't ask.

Search and Destroy

But what an assortment of commands *Word* makes available! Even the common ones have nifty bells and whistles. Take Search and Replace: both commands let you insert special characters to match "wildcards," "white space," tab characters, and so on. You can search or replace in either direction. And if asked to ignore case mismatches, *Word* will match the case of the replacement string to the case of the string it's replacing—"that" for "this," "That" for "This," and "THAT" for "THIS"—a neat trick many programs, including *WordStar*, are unable to manage. *Word* will even accept characters entered via the Alt key and the numeric keypad in search-and-replace strings, as it will in normal text.

On the debit side, *Word*'s Search command works only one occurrence at a time. The only way to find, say, the fifth appearance of the word "Josephine" is to do one search and then use the Shift-F4 "repeat search" key to do the search four more times. *Word* can't handle character attributes in search or replace strings, so you can't quickly underline a particular word throughout a document. If you tell *Word* to proceed with replacements without asking for confirmation, there's no way to watch what it's doing. And even when you're doing the confirmation yourself, Replace mode continues after each replacement until you stop it with the Esc key, so it'll send the cursor (sorry!) one occurrence further than you really would like. And depending on where the cursor is within the text, searches and replacements can be maddeningly slow. On the other hand, if *Word* finds no matches, it keeps the selection where it started.

Doing Windows

Word's amazing windows are also

invoked from the Command menu. From the keyboard, you open a window first by using the Window Split command, then by declaring whether you want a horizontal or vertical split and selecting the line or column where the window will begin. With the mouse it's even easier: Move the pointer to the right or top border, click the left or right key, and watch two double-ruled lines go straight across or down the screen. Primarily for the benefit of the mouse, windows don't share borders: each must have four borders of its own, thereby further nibbling away at an already mouse-size workspace.

A new window always contains a duplicate of the document active in the window whence it was cloned. Any changes you make to the document in the original window will appear in the new one, and vice versa. If you want a second copy of the document—a copy that will remain unaffected—you have to go through some rather fancy filework.

Loading a file into the window will wipe out its former contents. To simply clear a window, you use the Transfer Clear command. For some goofy reason, this command's default (fortunately protected by a subsequent prompt for confirmation) is "All" (that is, clear all windows and text); the one you almost always want is the other one: "Window."

When it comes to using windows, the mouse really shines. From the keyboard, you move from one window to the next by tapping the F1 key, but to jump from window 1 to window 8 without seven taps, you have to get to the Window Options menu and enter the number of the window you want. By that time, you might as well have done the seven taps.

With the mouse, you simply point and click at whatever text you're interested in, and the selection moves there. Closing a window with the mouse is as easy as opening one—just move the pointer to the top or right border and click both buttons.

From the keyboard, you can move the lower right corner of a window by supplying row and column coordinates with the

Window Move command. With the mouse, all you do is put the pointer at the window's lower right corner (where, in high-resolution mode, the pointer will change to a four-headed arrow), hold down a button, move the mouse to where you'd like the new corner, and release the button.

Unfortunately, it's often an exercise in futility either way. Since you can't overlap windows, and you can't move certain window corners from the right-hand or bottom borders, many of the moves you attempt are likely to be illegal.

Since the windows quickly begin to get exceptionally tiny, vertical and horizontal scrolling are essential (see Figure 2). *Word* lets you scroll left and right with the Ctrl-left and -right arrow keys, which take you one windowful in either direction. The unshifted arrow keys will take you a third of a windowful across the screen if the Scroll Lock is toggled on. With the mouse, it's much like vertical scrolling: Move the pointer to the bottom border, where the high-resolution pointer will change to a double-headed arrow, and use the mouse buttons to scroll or thumb—though no thumb marker appears in the border.

You move and copy text between windows just as you do within a window; just remember to switch windows first. A couple of warnings, though. When you save a window to a particular filename, *Word* (unlike *WordStar*) doesn't bother to check the disk to see if such a filename already exists. It's possible to overwrite a file you planned to use later on. And, amazingly enough, using the Undo key does not necessarily undo the latest edit in the current window. If the last edit was made in an inactive window, that is the one *Word* will reinstate.

The Window Options command lets you jump between windows, choose background colors (which doesn't do much good unless you're running in full multi-chrome), and turn on the ruler and style bars. The ruler replaces a window's top border and displays tab and indentation

settings. The style bar appears in the second column of the window (between the scroll bar and the selection bar) and displays certain paragraph style codes.

A Gloss on Glossaries

Word's glossary options are genuinely useful. When you've got a repetitive word, phrase, or paragraph, you can delete or copy it to a glossary abbreviation of your choosing instead of to the scrap. To bring it back, you can use the Insert option from the menu. Hitting an arrow key at the prompt "Insert from:" displays the various words in the glossary, and you can then use the arrow keys to select among them. But it's even easier to use the F3 Ref key. Just type in (or select) the proper abbreviation, hit F3, and the new text appears like magic on the screen.

If you remember to save your current glossary to disk before exiting *Word* (the program fails to remind you about unsaved glossaries), you can bring it and any other glossary back at editing time. There's no indication from the manual about how large glossaries or the entries in

them can be, but they apparently can accommodate substantial chunks of text.

Footnoting is amazingly simple with *Word*. Select the spot where the text reference is to go and choose Format Footnote. If you want to use a character such as an asterisk, just enter it; if you don't want a special character, simply hit the Enter key and *Word* will number the note for you in proper sequence. *Word* then whisks you to the end of the document, where it stores all notes. Type in the note, then use the Jump Footnote command to return to the reference when you're done.

You can delete and move footnotes simply by deleting or moving the reference in the text, or by opening a special Footnote window and working on them there. *Word* miraculously rennumbers them for you. They can be printed either at the bottoms of pages (columns, even, if you're using a multicolumn print format) or at the end of the document or section.

Though easy to create, running heads can be amazingly complex. You use the Jump Running Head command to move to the end of the document, where run-

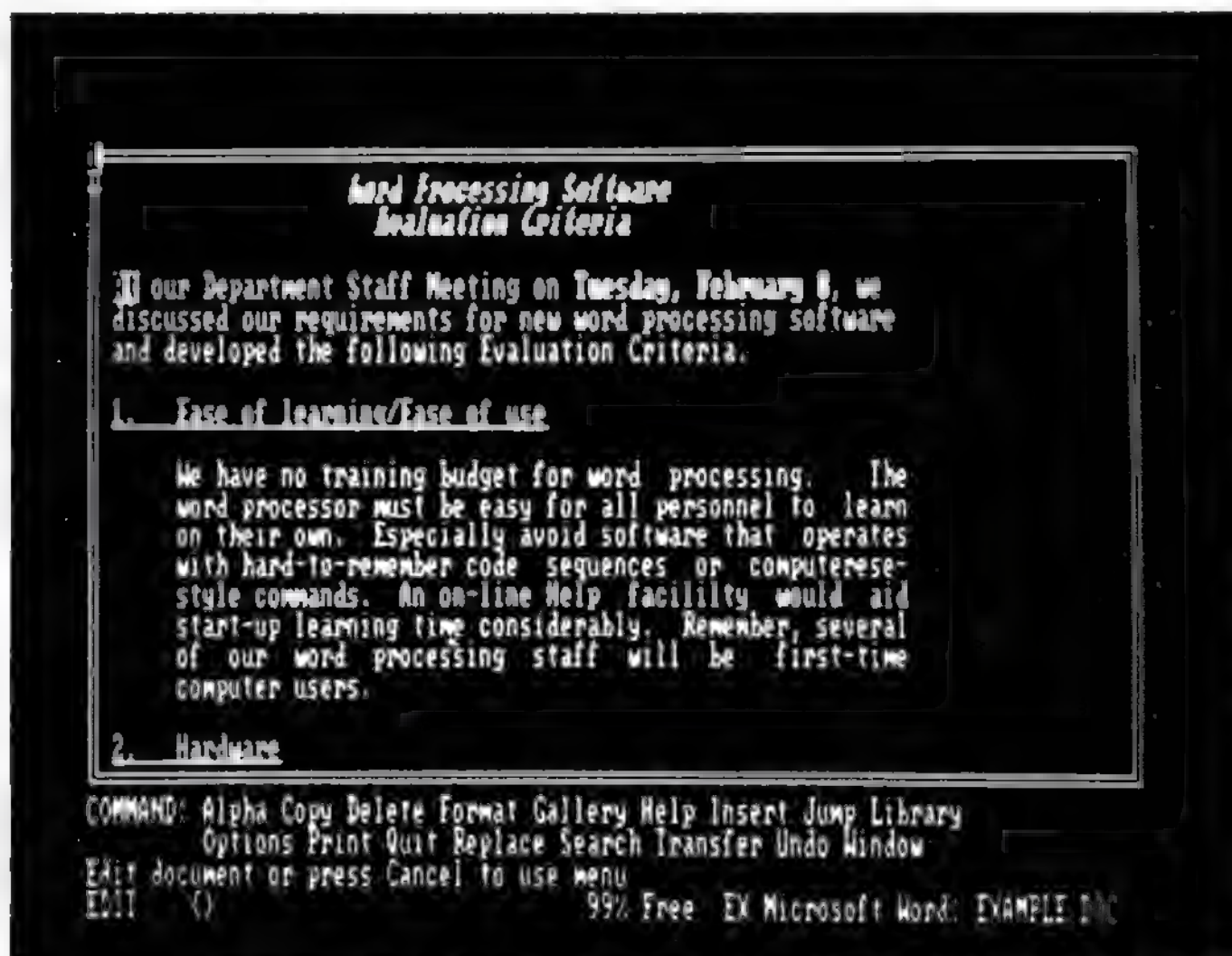


Figure 2: Horizontal and vertical scrolling are possible within a single window. Note the "Gumby" cursor or selection stretched over an entire sentence.

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ning heads are stored. Type your text, select it, and choose the Format Running Head command. You can choose whether the head will appear on the top or bot-

tom of the document, or odd- or even-numbered pages, and, *mirabile dictu*, whether it will be omitted on the first page. Alas, when you're done entering

the running head, the Jump command takes you not to your prior position in the text, but to the beginning of the document. Try and find your way back to place. Just try.

Word's tabbing functions are equally versatile and complex. Choose Format Tabs and the top border will turn into a "ruler" showing a digit every ten columns, the left and right margins, the standard paragraph indentation, and the tab settings you've entered. However, *Word* does not deign to show you its preset tab settings; you just have to know they turn up every five spaces.

Now, *Word* doesn't give you just plain ordinary tabs. Sure, you get the old familiar tabs that just let you type in text at the cursor (!) position, plus *WordStar*-style decimal tabs that let you align rows of numbers. But you also get tabs that let you right-justify whatever you enter and tabs that center the text. And, for such things as tables of contents, you can have the tabs fill themselves with dots, dashes, or underscores. I used that option and the right-justifying tabs to create this short document:

Fall of the Roman Empire 37
Rise of the Working Class 3755

Format Fascination

The amazing variety of Format commands lets you reformat anything from an entire document to a portion of one. The Format Character command lets you apply character attributes to a selected block of text and even change the type size and font. Normally, though, you use Alt commands to apply attributes to selected text—Alt-u for underlining, Alt-b for boldfacing, Alt-shift-+ (but *not*, as the manual omits to tell you, Alt-gray +) for superscripting, Alt-minus (but not Alt-gray minus) for subscripting. If you want to boldface a whole paragraph, simply select it, hit Alt-b, and it's done.

There are a couple of catches to this method, though. Just as *WordStar* makes it difficult to underline the spaces between words, *Word* makes it difficult *not* to.



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Selecting and underlining word by word doesn't help, since *Word*'s selection by word includes the following space.

Another minor irritation is that inserting material directly in front of a character with attributes gives the inserted text those attributes as well. Even an invisible paragraph marker can pick up the unwanted style, thereby causing all text inserted in front of it to do so, too. Fortunately, you can remove all character attributes from selected text with the Alt-spacebar combination.

Paragraph formatting works much like character formatting: You can apply it with Alt commands or with the Format Paragraph option. When you set a paragraph format, it stays in effect for all subsequent paragraphs until you change it.

You can set the paragraph flush left or right (Alt-l and Alt-r), justified on both sides (Alt-j) or centered (Alt-c). Alt-f indents the first line half an inch from the left margin, and other Alt commands (or Format Paragraph options) let you set the indentation of the first and subsequent lines of a paragraph to create all manner of jazzy hanging indents and "outdents." You can set double spacing, and you can insist that a given paragraph or paragraphs have a blank line above and/or below. You can even tell *Word* not to break a paragraph between two pages.

One Document, Divisible

Finally, there's the Format Division command. A division is basically a section of text that will be printed with a given page format. Usually the division turns out to be the whole document. But if you want to change margins, column layout, running heads, or page number placement, sequence, or format in the middle of the text, you need to start a new division by hitting Ctrl-Enter.

For each division, you can specify the margins, page length and width, page numbering (including such unusual options as letters and roman numerals!), number of columns (and the amount of space between them), the position of the

running head and footnotes, and what kind of break (if any) will occur between the current division and the previous one.

The final formatting option is Format

Style. This option allows you to create what Microsoft calls a "style sheet" and attach it to your document. The style sheet is amazingly powerful and equally diffi-

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cult to understand. Essentially, it lets you apply all the commands from the Format Character, Paragraph, and Division menus to the document for keeps.

This you do from the Gallery menu, where you find a set of options that look remarkably similar to the ones on the Command menu. *Word* has its own stan-

dard formatting defaults built in. Unfortunately, you can't look at them—the default style sheet is invisible—but you can change them. If, for example, you want every normal paragraph to begin with a half-inch indentation, you can change the normal paragraph format to do just that. You can also change the Alt formatting commands; the old ones will remain accessible by hitting Alt-x before the original letter. The feature should be invaluable for special formats such as movie and television screenplays (but not the two-column "audio-visual" format; *Word* will print text in two-column format but won't display it that way on the screen).

Figuring out the use of the Gallery menu isn't easy, though. Mediocre as the documentation is in general, it's absolutely wretched on this point. The way I began to penetrate the mysteries of style sheets was to load the sample called "DRAFT.STY" from the program and study it and its effects on my text. Eventually, I figured out some of the manifold powers style sheets have to offer, though I'm sure much remains that I haven't yet tapped.

If you want to give all your headings a particular look, or superscript all your footnotes automatically, this is the place to do it. Good luck in figuring it out. I'll offer you this one tip: If you're having trouble trying to delete a style sheet from a document, you'll find the method hidden away on page 155 of the manual.

The Fonts of All Wisdom

Word's manual says the program supports 64 fonts, has an internal measurement accuracy of better than 1/1000-inch, and is capable of supporting forthcoming laser printers and typesetting equipment. I don't own a laser printer or a typesetting machine, so I wasn't able to test this claim.

It's clear, however, that *Word* does not yet directly support any printers except the few listed in the manual: Epson MX-80 with and without Grafrax Plus, Epson

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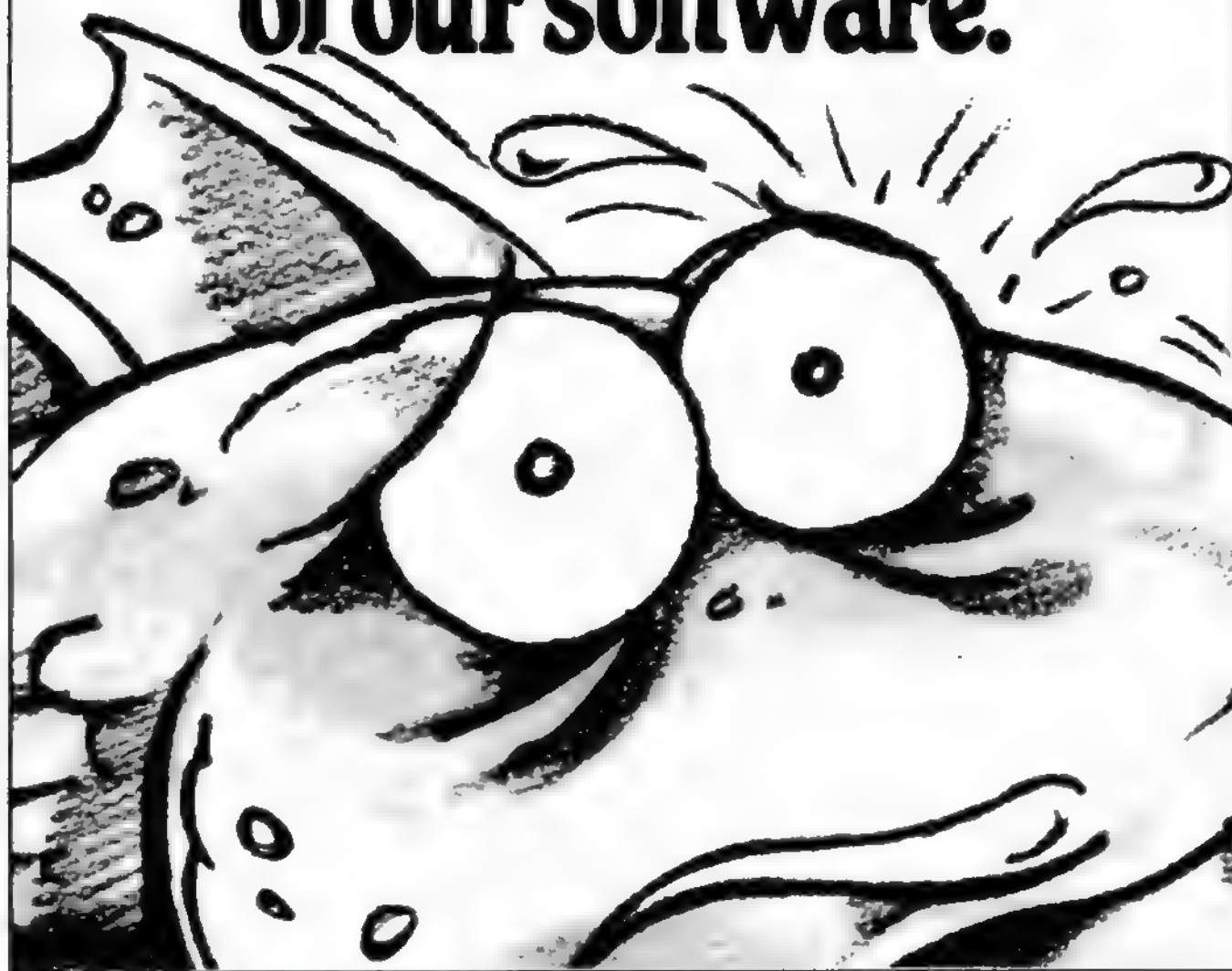
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FX-80, and IBM Graphics Printer (all dot matrix); NEC 3550 and 7710, Diablo 630 API, Qume Sprint 11 Plus, C. Itoh Star-writer FP-1500-45P, TTY and TTYBS Serial Teletypes.

Though the manual is silent on the point, the situation is somewhat better than it appears at first blush. You can, for example, pretend an unsupported parallel printer is either a teletype or a backspacing teletype (which won't do super- or sub-scripting), and I suspect you can fool a parallel-connected NEC 7730 into thinking it's a 7710.

Still, that leaves a lot of people—Okidata and IDS users spring immediately to mind—with less than marvelous support for their machines. They can, of course, develop their own printer drivers. As the manual puts it: "First, an imaging device driver must be written to convert the Microsoft Print file format generated by *Word* into the control sequences of the particular device. Once this is implemented, a printer description file must be created for each printer." If that sounds like fun, there's plenty of information in the manual on how to proceed, but none of it helps unless you're a hotshot assembly-language programmer.

Since you've already selected most of the potential options via the Format commands, there's not much left to do at print time. You can print just the currently selected text, the entire document, or any combination of page numbers—even skipping over pages. On the other hand, as I learned to my chagrin, it's possible to enter an invalid print command, wait 10 minutes for the print formatter to finish, and watch nothing print out.

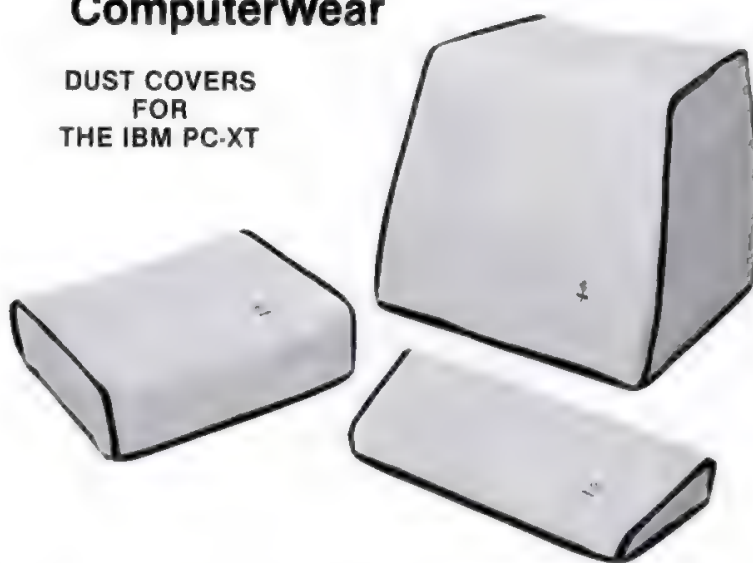
You can print multiple copies; the program accepts numbers up to about 32,000, although I didn't get quite that far myself. You can even queue-print, but that option has been implemented in the same kludgy way as in *VisiWord*: wait 2 minutes short of forever while the print formatter writes the whole file to disk and then return to a very sluggish version of the text editor while printing goes on.

There's also something called Print Direct, which supposedly lets you use your printer as a typewriter. Not really: most printers have at least a line buffer,

which means nothing you type will be sent to the printer until you hit the Enter key. I've seen handy utility programs that work a line at a time, but Printer Direct mode

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THE UNFINISHED WORD

here is a stiff. As you type, not a single character is displayed on the screen.

On the other hand, *Word* can perform impressive tricks at print time. If you've

asked for double-column text, by God, that's what you get. Unless you specify otherwise, *Word* will protect you from widows and orphans—single lines of

paragraphs at the tops or bottoms of a page. And if you've entered a letter like ñ via the Alt-plus-numeric keypad method (164 here), *Word* will backspace your printer to make sure ñ is what you get, señor or señorita. The use of numeric keypad commands means it's possible to embed printer commands in your text. You might even save some of your printer's fanciest codes in a glossary and read them in with a couple of mnemonic keystrokes.

One thing I learned by accident: *Word* won't remind you to save your text after a printing session unless you forgot to save it beforehand. Since all the pagination is lost, remember: save *after* printing, or wish you had.

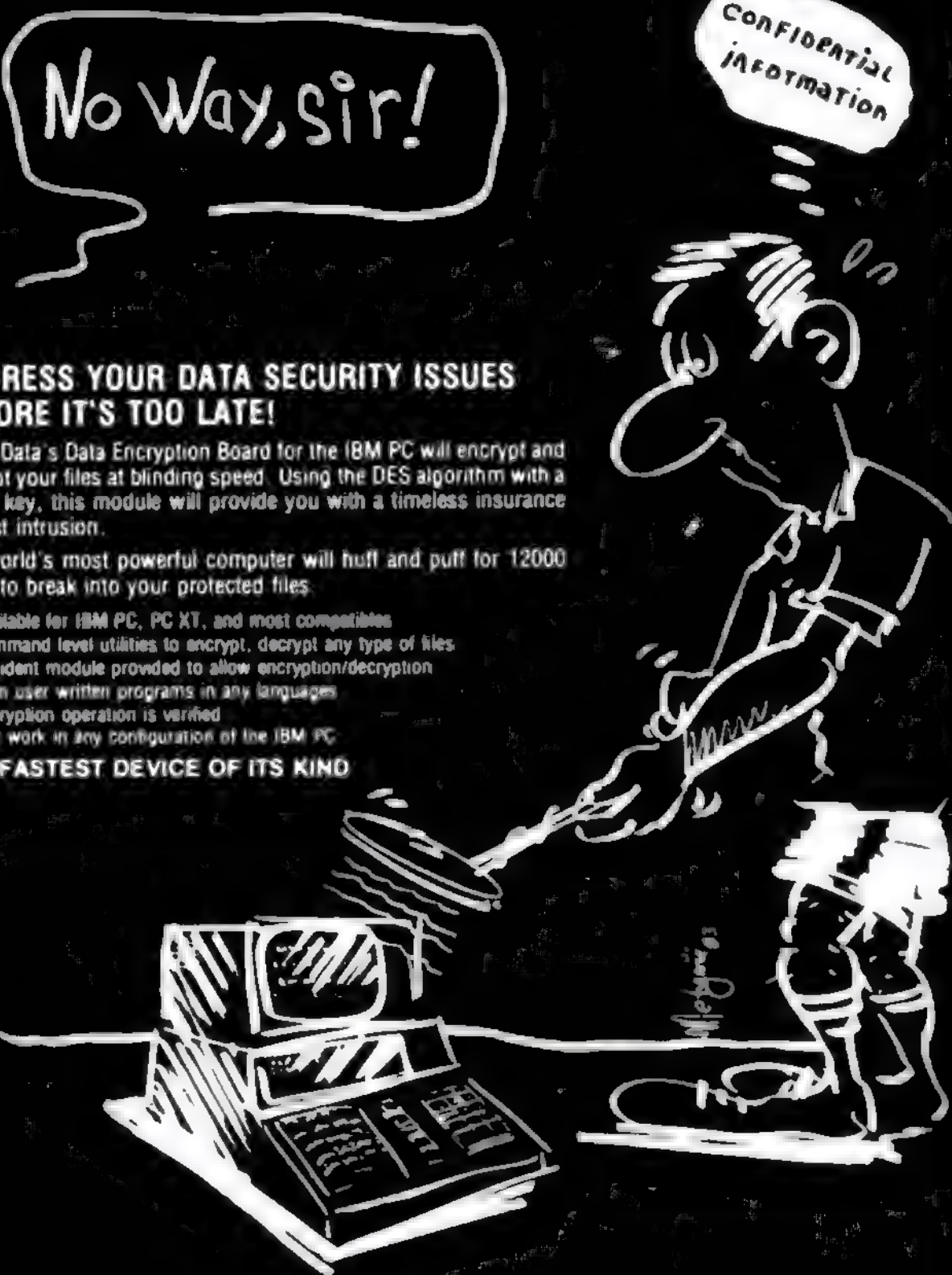
Rollie Fingers It Ain't

If *Word*'s best aspect is its power as a print formatter, its worst has to be the lethargic pace at which it saves files. Saving text to disk, as I've said in these pages again and again, is absolutely essential if you're going to avoid disaster. I've even written a special batch file for *WordStar* that lets me work on a fake disk and save my precious text to a real one.

Word's heart is in the right place. It makes an automatic backup file, and saving requires only four keystrokes (or three mouse move-and-points), which could have been reduced to three had the Save option instead of Load been the submenu default. But performing a save on a floppy-drive system (and RAM disk won't help, remember) is like making a date with a glacier. It'll get there . . . eventually.

Saving this review has taken anywhere from 2½ to 3½ seemingly endless minutes full of disk drive racket—more than thrice the time of *WordStar* at its slowest. That is not the high road to text integrity. Every time I've decided to add a line here and there, I've shuddered at two thoughts: first, finding it, and second, going through the save process. Saving is so slow that I have to advise against using this program without a hard disk system.

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while the save is going on and on. With *Word*, your text disappears from view only when a new window is being loaded or you've asked for a directory of a disk or glossary.

There's no access to DOS commands from *Word*, so you can't format disks, check file sizes, or even copy files directly—a shame, since exiting to DOS is such a bother. Worse, *Word* takes over your machine in some peculiar way that precludes the use of keyboard enhancers. *ProKey* fans will be sadly disappointed. Another minor annoyance is that *Word*'s data drive default has to be changed at startup. *Word* remembers many parameters, including whether you want it to remain silent instead of beeping when you make a mistake. But for some reason, it can't remember a default drive other than drive A.

The line-25 indicator that tells you how much free space is left doesn't make a whole lot of sense, and the manual doesn't really tell you what it means. Nor is it clear from the manual what limits the maximum file size. Apparently free space on the program disk, where *Word* keeps its scratch files, is the major limitation, since free space miraculously increases after you perform a save even though the document hasn't grown shorter. Files can be merged if there's space for them, but *Word* offers no way to link files at print time.


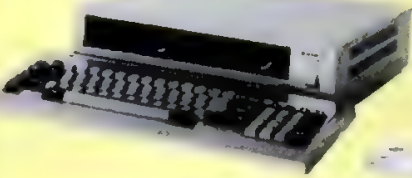

Microsoft has recognized the primacy of *WordStar* by providing a utility program to convert files from the rather weird *WordStar* format. Invoked from DOS rather than from within *Word*, the utility program flags all *WordStar* dot commands with three asterisks, but unfortunately may stick unwanted extra spaces in the converted files.

Help!

Word's 400-page manual does have an index and an extensive reference section. The index often refers you to pages that don't have much bearing on what you're looking for and fails to refer you to the pages that could truly help. The reference

section is organized logically but it is incomplete. The manual's overall organization is abysmal; for information on positioning running heads on a page, the index

referred me to pages 81, 85, 140, 144, 222, 259, and 268—none of which held the answer to my question. (I still don't know how the F4 (Repeat) key is sup-

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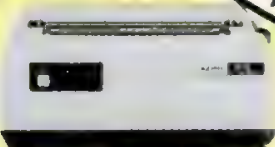
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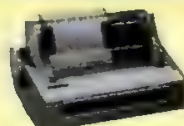
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THE UNFINISHED WORD

posed to work, since it's not included in the index and I can't remember seeing a trace of it.)

Although the short tutorial that's

included at the beginning of the manual lets you work with a couple of disk-based files, it doesn't remotely begin to help you tap *Word's* considerable powers.

In sum, Microsoft's utterly humorless technical writers don't seem to have any idea of what people in the world outside Microsoft's hallowed halls need to know. The company's new publishing division will probably fly on *Word* books alone.

At least you can use Alt-h to get help from *Word's* copious and detailed help screens. The screens are context-related—press Alt-h when the Format command is highlighted, and you'll get information about formatting. The help screens are genuinely helpful, but there's plenty of information you can't find there—the codes for Alt key formatting, among other things. There's no keyboard template, which is a shame. There is a quick-reference “card,” printed on paper so thin that you'll wear it out real fast.

Microsoft's non-toll-free hot line helped with some of my questions. Getting through, however, took seven tries over a three-day period. Phone early in the morning or plan on hearing a lot of busy signals.

Summing Up

The world is dividing up into mouse friends and mouse foes. Programmers, notoriously poor typists, tend to line up among the former. Count me among the enemies.

I took a quick survey of ten desks at the PC offices. Not one had the 10-inch square area of free space (nearly as big as the top of a PCjr) that Microsoft's mouse manual claims is needed for best performance. On my cramped computer stand, sideways mouse moves required as many as five short strokes.

Since there's a certain amount of mechanical play in the mechanism (and the muscles), the mouse often slid off course when I thought I was pulling it in a straight line. Hitting the various “bars”—particularly the one-column-wide “selection bar”—required a very careful touch. The mouse took up an extra slot in the backplane of my machine, added a distracting additional cursor to the screen, and forced my hands off the keyboard

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every time I used it. To paraphrase Seymour Rubinstein, creator of *WordStar*: Mice are great for people with three arms.

There are additional problems. I don't use mailing-list capabilities much, but people who do won't find them in *Word*. And those who are fanatic about saving their text had best get a hard-disk system if they don't want *Word* to drive them to distraction.

In many respects, Microsoft's *Word* does not compare favorably with *WordStar*. I use *ProKey* to configure *WordStar* the way I want it. I put it on a RAM disk that makes saving text quick and easy. *WordStar*'s place markers, block moves, and special navigational commands make getting around in my text exceptionally fast. *WordStar* doesn't underline the spaces between words. It lets me know how many characters and pages I've typed and lets me preview my page breaks before I waste time printing. It lets me insert nonprinting comments. And it doesn't treat me like a thief by refusing to let me make all the backup copies I need.

Despite its negative aspects, however, *Word* is the first word processing program I've tried that's made me consider abandoning *WordStar*. It's a joy not to have to reformat paragraphs by hand, and turning a single-spaced document into a double-spaced manuscript takes just a few keystrokes. And Microsoft's computer whizzes have been able to take advantage of many of the PC's subtleties: Somehow they've managed to make the difference between a simple hyphen and a nonbreaking hyphen (entered with the gray minus key) show up even on the monochrome monitor!

Sometimes I get the feeling that programmers insist on starting everything from scratch when designing new programs. *Word* clearly shows the advantages of that method—and the disadvantages. Freed from the excess baggage of the past, programmers can create a program that does its stuff in exciting new ways. But

they can also forget necessary features users need and have come to take for granted.

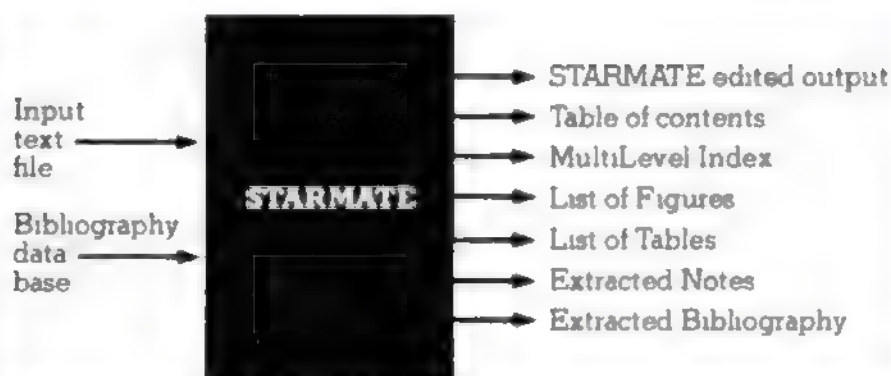
Programs change in response to users'

needs, and I expect *Word* to get better as it evolves. Right now, I'd say *Word* is a forward-looking program about two releases away from potential greatness. ■

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Phosphor Green Tinges The Silver Screen

Scriptor's automatic script formatting is a godsend for Hollywood screenwriters who have turned in their typewriters for PCs.

If you're a screenwriter, director, or producer, you've probably found that no matter how "user friendly" word processing software is supposed to be, it can turn downright cold when confronted with the rigidity and complexity of a screenplay format. This format includes separate tabulation settings and spacing for items like characters' names, dialogue, and description; items that must be typed in all capital letters; and rules for scene numbering, page breaks, and the placement of scene transitions (CUT TO:),

sluglines (INT. STUDY - NIGHT), and indicators like (MORE) and (CONT'D).

The ordinary word processing program puts you through finger calisthenics trying to get it all right. Even programmable "keyboard enhancers" like *SmartKey* and *ProKey*, although helpful, don't really solve the problem. They reduce the number of keystrokes somewhat, but you still have to handle page breaks, spacing, transitions, sluglines, and indicators manually. When you make a change in a scene the software automatically repaginates,



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SCREENPLAYS

totally messing up the format.

Only recently has software begun to appear that streamlines much of the aggravating clerical work needed to format an average script. *Scriptor* from Screenplay Systems, Inc., is one of the best of these. It frees the writer (or rewriter) from having to format and reformat a screenplay while struggling to create a story. *Scriptor* is designed to work with a data disk already prepared using a standard word processing package—it is not itself a text editor. The manufacturers say you can use *WordStar*, *Perfectwriter*, *The FinalWord*, and *Spellbinder*, among others. However, the manual seems to concentrate on *WordStar* and *Perfectwriter* features.

In addition, you have to write your screenplay using *Scriptor*'s imbedded codes, which are (thank goodness) very few. These codes control elements such as scene numbers, sluglines, underscoring, forced page breaks, omitted scenes, and bypass formatting for problems like simultaneous dialogue. The *Scriptor* manual gives you explicit instructions for doing this.

You still have to type your script in a reasonably standard format, while paying attention to spacing and to at least the left margins of the various columns for characters' name, dialogue, and so forth. This is where having keyboard enhancers comes in handy. However, you don't have to be as neat and careful about the columns as you would otherwise, because *Scriptor* will fix the margins later.

Once you have typed in your draft, you are ready to format it. Formatting with *Scriptor*, although a great improvement

Scriptor

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A Sad Story

This example of *Scriptor*'s output shows what can happen when the complexities of screenplay format get to be too much for a writer to bear.

1 INT. DARK MUSTY OFFICE—LATE NIGHT

1

He had been working at the typewriter nonstop for 48 hours. Mere exhaustion had long ago given way to a screaming desire for sleep. But he keeps going, crawling and scratching to reach the end of his latest masterpiece. As the grandfather clock in the corner strikes 4 a.m., he pulls the last sheet from the Smith-Corona and holds it up to the single lamp above his desk.

WRITER

(Sighing)

'The End.' Finished!

(Then becoming excited)

It's finished! . . . Finished!! My
baby, my Oscar, it's done!!!

He jumps up from his desk and runs to pour a much-needed Scotch on the rocks.

2 INT. OFFICE—A FEW MOMENTS LATER

2

The gentle, comforting taste of the liquor barely washes across his tongue before he realizes . . . it's not finished. A look of despair comes over his face, a lone tear running down his cheek.

WRITER

What, am I crazy? I'm not through.
I still have to retype this whole
script in polished form. It's
always the same . . .

(Beginning to cry)

I don't think I can do it again.
I can't type another word. I
can't! I just can't!

(CONTINUED)

over manual methods, is a complicated affair. You should not expect to boot up and immediately begin using it on real material. It will take time, patience, and practice with the manual's exercises to familiarize yourself with the procedure. Basically what's involved is choosing a number of variables for margins, spacing, placement of scene numbers, etc. *Scriptor* supplies a standard template with defined values for these variables but you can amend any of the values to create your

own custom format. *Scriptor* allows you to create and store 16 custom formats, and offers you the choice of three overall script styles—screenplay, shooting script, and variety show. I am told by the designers that they plan to include a situation comedy format in their next program update.

Once you have made your choice of format and script style, the program works on your screenplay largely without any assistance. When I tried it, using the stan-

dard screenplay format with a few margin and spacing changes, my 120-page script took about 20 minutes to complete. You can let the program run entirely automatically, or you can set it to prompt you when it comes to a dialogue or scene break. It emits a beep, and if you want to change where it has placed the break, you can do so. In 99 percent of the cases in which I used the prompt, I agreed with the program's break choices and allowed it to proceed on its own.

Another enormously helpful function of *Scriptor* is "Error Correction Level." Inevitably, somewhere in your script lines will be mistabbed or misplaced from their predetermined columns. If a line is only one space off, chances are you won't notice it, but *Scriptor* is prepared to catch these little faux pas. You can choose to have the program ignore the error or correct it. When set in the "correct" mode, the program stops formatting and beeps when it encounters a line that doesn't correspond to any of your preset columns. It then enters "Error Correction Level." A new screen displays the misplaced line, indicates the appropriate column, and offers a quick and simple procedure for making the correction.

Once your script is formatted, it isn't set in stone. You can make changes and then reformat automatically. *Scriptor* is therefore useful not only to writers, but to directors and producers, who often insert or delete scenes while the film is in production. *Scriptor* can replace deleted scenes with the word *OMITTED* and still maintain the scene numbers. It can also renumber the scenes in a revised script whenever necessary.

When it comes to printing, *Scriptor* offers you the choice of producing the entire screenplay or selected individual pages and scenes. At the end of my trial run, I had in hand a finished screenplay, perfectly formatted, all scenes numbered and ready for the producer. And I can always go back and re-edit the material, reformat it, and print out the whole script, or just the parts I need, at any time.

2 CONTINUED:

2

A maniacal look suddenly appears in his eyes. He picks up the bottle of expensive Scotch intending to smash it against the wall, but stops short, caressing the bottle to his chest. His stare then moves over to the Smith-Corona. He gently puts the bottle down and slowly stalks to his desk, sneaking up on the unsuspecting machine. Grabbing it from behind, he raises the old workhorse over his head and smashes it to the floor, a wild, psychotic laugh exploding from his lips.

3 INT. OFFICE—STILL YET ONE MORE MOMENT LATER

3

WRITER

I won't do it again! I won't ever do it again! There must be a better way . . .

(With maniacal insight)

Yes, that's it. I'll get a computer. That's what I'll do!

Word processing . . . Yes, yes . . .
a computer . . . ha, ha, ha, ha . . .

(Becoming solemn)

But wait! What if I have to add or delete a scene? Change anything? It'll be the wretched curse of the "A" and "B" pages, my whole format a mess.

The writer opens his desk drawer and, with a trembling hand, slowly takes out an old Colt .45 revolver. —H.B.

Manual Bugs

Scriptor's 194-page manual is exhaustive and reasonably easy to understand. It describes each element of the program in sections entitled "Writing for *Scriptor*", "Creating and Altering a Format", "Formatting a Screenplay", and "Printing a Screenplay", and it supplies numerous examples and illustrations. The manual not very technically written, which is a boon to the average non-techie screenwriter. However, it still has a few bugs in it. For example, although the new IBM version of *Scriptor* runs under PC DOS, the opening few pages of my manual are written for CP/M. The section on "Preparing *Scriptor* for Your System" is therefore a little confusing, especially if you, like me, have no idea what CP/M is and are suddenly faced with commands that look like the formula for a nuclear bomb. The designers assured me they are preparing a revised manual. In the meantime, it comes with an insert explaining the requirements for using PC DOS.

Another flaw is the incomplete explanation of how to format multiple disks. Most screenplays will probably take up at least three disks, especially when you consider the backup files you will want to create. When dealing with multiple files on multiple disks, *Scriptor* tells you to create a separate file, called an "Indirect Command File," using your text editor. That file lists, in order, the individual files making up your complete screenplay, which tells *Scriptor* that your screenplay is spread over a number of files, what their filenames are, what disk drive they're in, and in what order they should be formatted. The file also allows *Scriptor* to signal you while it's running if the disk needs changing.

What *Scriptor's* manual doesn't make clear is that this "Indirect Command File" has to be copied right onto the master *Scriptor* disk. It's an easy enough copy job, but to the novice, the thought of having to play with a "master" is frightening. *Scriptor* is on a protected disk so you can't make a backup copy. The package does,

however, come with a second usable disk.

The manual's diagram, "Formatting Multiple Files," would be far more helpful to users of the program if it included another box at the top explaining just how the "Indirect Command File" is created, and specifically, how to copy it onto the *Scriptor* disk. Once you understand the



Scriptor frees the writer from having to format and reformat a screenplay while struggling to create a story.

process, it's really quite simple, but a better explanation wouldn't hurt.

Quick Trip

The manual includes an invaluable hands-on exercise called "Quick Trip Through *Scriptor*." Don't miss it, even if you think you're too sophisticated for the elementary parts of the instructions. "Quick Trip" is essential to becoming familiar with *Scriptor's* operating format. I found the exercise easy to understand, and I experienced my first real sense of accomplishment when the printer produced exactly what the book said it would.

If a user has a question about procedure, or about some specific application peculiar to a particular writer's style that

Scriptor doesn't address, Screenplay Systems is ready to help. Without telling the company that I was writing a review of their product, I made an appointment to speak with them about the program and my particular application. Company representatives spent a considerable amount of time familiarizing me with the program and explaining how to integrate it into my system. They made no claims beyond what *Scriptor* could do, and their approach was comfortably soft-sell. They emphasized that they would continue to be available to help with any questions or problems I might encounter after purchasing *Scriptor*. I also checked with friends using *Scriptor* and they confirmed that the organization gave them good support.

Screenplay Systems is willing to work with writers to customize *Scriptor* to their needs. No installation program is required, and Screenplay Systems will supply updates, at a minimal charge.

If you consider the time and aggravation that goes into retyping your material before it's ready for copying, *Scriptor* is more than worth its \$295.00 price. And if you consider the current costs of having a screenplay typed or word-processed by an outside service, your savings might pay for your entire computer system. The last script I did on my old Selectric typewriter was word-processed at a cost of \$800 for two computer-generated drafts and one set of revisions. And there's one very important difference between doing it yourself and going outside. No one else need see the script until it's complete, so there is no need to fear having unregistered material ripped off by an unscrupulous typist.

An increasing number of customized software packages are addressing the complex and diverse needs of the entertainment industry. What I'm waiting for now is a program for my PC called "Agent." If *Scriptor* is so cost-effective, then this one would be priceless. ■

Harvey Berger is a California-based screenwriter who has recently become an IBM PC owner and enthusiast.

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The Selectric Connection

With a little bit of work, a fair amount of money, and the willingness to put up with some limitations, you can transform an IBM Selectric typewriter into a printer for your PC.

If you've just bought an IBM PC, and you already own an IBM Selectric typewriter, the question, "Why can't I use my IBM typewriter as a printer for my PC?" may pop into your mind. Well, as a matter of fact, you can, but it may not be worth the effort.

There are several ways to make the connection, depending upon which model of the Selectric you own. The electronic Selectrics, models 50, 60, 65, 75, and 85, adapt most easily, since they were designed with microcircuit relays, which can be easily connected to a serial or par-

allel output port on the PC. The older Selectric II and III models are much more difficult to connect and will not be dealt with here.

California Micro Computer, in Huntington Beach, California, manufactures a typical connection device, the CMC 5060 module. I recently installed it in an IBM Selectric 50 typewriter with good results. The same module also works with the model 60 and 75 typewriters. (IBM itself just released a module for connecting the model 65 and 85 typewriters to the PC).

Before you attempt to make the connection, though, it is important to understand the pluses and minuses of using a typewriter as a printer. You should realize that IBM Selectric typewriters were not designed for use as printers, so they have certain inherent drawbacks. They print only 16.5 characters per second, which is slow compared with most letter-quality

printers. They are very noisy, so you may want to buy a silencer. Furthermore, these typewriters do not support through software control the many common printer functions, such as type pitch and spacing or right- and left-justified proportionally spaced text. In addition, using a typewriter as a printer puts it under tremendous strain, so you should expect it to break down more frequently than a dedicated letter-quality printer would. You should also know that installing a connection module will not void your IBM service contract, but you can expect to pay at least \$100 more per year if you want to keep it.

With all of these drawbacks, why make the connection at all? The main reason is that IBM Selectric typewriters provide outstanding type quality—better than that of any letter-quality printer currently available. Using different IBM Selectric type "balls," you can obtain pica, elite, italic

CMC 5060

California Micro Computer
17791 Jamestown La.
Huntington Beach, CA 92647
(714) 847-4141

List Price: \$295; connector, \$75.

CIRCLE 724 ON READER SERVICE CARD

or proportionally spaced print. With a carbon ribbon the quality is almost as good as that of typeset documents. Also, assuming you already own the typewriter you can get a printer for just the price of the connection module.

Making the Connection

The CMC 5060's photocopied manual is no worse than many other computer manuals. The text is reasonably easy to follow, although you can expect to spend at least 2 hours, not the half hour CMC advertises, on the connection process.

First, open up the IBM typewriter by moving the sliding latches. The diagram in the manual makes it look as if there is only one slot on each latch where a flat bladed screwdriver can be inserted, but this is not true. The sliding latches run the full length of the typewriter from front to back on both sides and have two slots cut into them. One is near the front of the typewriter, one near the middle. You should insert the screwdriver into the middle slot, where you are less likely to damage delicate components. As an additional precaution, tape the blade on the screwdriver before prying open the latches.

Once you have the cover off, raise the typewriter to the vertical position for easier access. Then examine it carefully to determine how to connect the CMC 5060 to the IBM cable. Take your time and make sure you line up the pins before you push the cable ends together. Follow the directions to make the remaining connections.

The final hardware connection requires special care. IBM Selectric typewriters provide automatic line feed with each carriage return. For proper operation, most word processors require that this feature be disconnected, so the CMC 5060 has a separate wire that connects to a small magnetic relay on the right side of the typewriter in order to turn this feature off. This magnetic relay has a very delicate pin; you must be careful not to break it off when you push the 5060's connector onto the pin. You can minimize the breakage

Printer-Setup File Modifications

Printer initialization sequence	Esc Q Esc A
Backspace on printer	ASCII 156
Form feed valid	No
Start of underline mode	Esc U
End of underline mode	Esc I
Set left margin	Esc W
Release margin	Esc Q
Set tabs	Esc S
Clear tabs	Esc A
Redirect output to serial port, 300 baud, 1 stop bit, 8 data bits, no parity check.	

Figure 1: Specific printer-setup files do not exist for IBM Selectrics, but these modifications enable you to control additional printer functions from the PC keyboard.

potential by wiggling the pins when you connect them.

When you finish, make sure all of the cables and wires are clear of the typewriter's moving parts, particularly the bottom of the carriage, which may be obstructed by the rubber mat at the bottom of the typewriter. To prevent the carriage from becoming obstructed by the mat, double check all parts and cables to insure that they are lying flat at the bottom of the typewriter when you reattach the cover.

This completes the typewriter modification process. All you need to do now is connect the CMC supplied RS 232C connector to the serial port on your PC or, if you purchased the parallel connection, simply connect the CMC 5050's cable to your parallel port. You can now use the typewriter as a printer.

Software Adjustments

Using a typewriter as a printer presents several programming problems. In order to understand the problems and learn how to solve them, you need to know the basics of how electronic typewriters and the CMC 5060 (and other similar modules) work.

Electronic typewriters, such as the Selectric 50, use a sophisticated relay system. When the operator strikes a key, a signal is sent to a microprocessor, which in turn sends a signal to the relay instruct-

ing the type ball which character to print and where to print it. Some keys enable nonprinting functions, such as setting tabs or margins. With the Selectric 50, the relay actually sends out signals to seven different switches, known as bails and reeds. Each switch can be set either on or off, creating 27 or 128 possible combinations. Similarly, when you use the PC keyboard and transmit characters to the typewriter, the 5060 module converts the PC's ASCII character into the equivalent Selectric signal to properly set the bails on the typewriter.

This process works fine as long as there is an equivalent typewriter code for the ASCII character you are sending. Regrettably, this is not always the case. The CMC module handles this problem by transmitting a "no print" signal to the typewriter for each undefined character you try to transmit. The actual mapping of ASCII to Selectric characters is shown in a table in the CMC documentation. Unfortunately, the table is not accurate for all Selectric type balls. The standard letters and numbers remain in place, but unusual symbols may occupy different locations on various models. On the proportional-spacing model 96 ball, for example, ASCII character 92 is the cents (¢) symbol, not the ampersand (&) symbol, as shown in the manual's table. Similarly, ASCII 62 is the colon (:) character, not the

fraction $\frac{1}{4}$, as listed. You should check the accuracy of the table if you plan to use any unusual symbols. The best way to do this is to transmit the first 127 ASCII codes to the typewriter from your word processor and take a look at the result. You should perform this accuracy test for every new type ball you plan to use.

Using the proportional-spacing ball presents more serious software problems. On this ball, each character takes up a different amount of space, so two lines containing the same number of characters may have different lengths, which leads to difficulties. In order to line up a table, for example, most word processors simply count the number of characters from the left margin to the beginning of the next column. If the character size is fixed, this works fine. However, with proportional spacing, each line of the table may begin in a different place.

The same problem arises when underlining. Most word processors underline by, first, causing the printer to perform a carriage return with no line feed at the end of the line of text. Then the printhead moves the correct number of spaces to the beginning of the word or phrase to be underlined, and the appropriate number of underline characters is inserted. This procedure fails to work with the proportional-spacing ball, since merely counting spaces will not put the printhead in the correct position. Similar problems may be encountered using the equation, subscript, and superscript modes.

The solution is to use the built-in microprocessor in the electronic typewriter. The CMC 5060 allows you to transmit typewriter control codes directly from the PC. These commands allow you to control features such as underlining, tab setting, and column alignment by using typewriter commands rather than word processing commands. This allows proper underlining and column alignment even for proportional spacing.

Special Characters

In order to underline, line up tables,

overstrike, and set margins and tabs in the proportional-space mode, you must transmit escape codes from the PC to the Selectric. An escape code functions the

**The CMC 5060
allows you to
transmit typewriter
control codes
directly from the PC.
These commands
allow you to control
underlining, tab
setting and alignment.**

same way as the equivalent code key does when using the Selectric as a typewriter.

The escape codes are easily transmitted from the PC to the Selectric using the CMC 5060 module. For example, to underline a single word on the Selectric, you would normally type the word, then press Code I. Similarly, to underline a whole phrase, you would enter Code U first, then type the phrase, then enter Code I. To underline a single word using the PC, type in the word from your word processor, then transmit Esc-I to the Selectric. To underline a whole phrase, first transmit Esc-U, type in the phrase, then transmit Esc-I. The main difficulty is in getting the word processor to transmit the correct escape code at the appropriate time.

Few word processors have a printer-setup file specifically designed to instruct a Selectric typewriter to underline, overstrike, print compressed type, and so on. Therefore, you will have to modify the file supplied or create your own.

I have found it necessary to modify the printer-setup file on my PC as shown in Figure 1. These modifications solve many of the problems inherent in using a Selectric as a printer. Printer initialization clears tabs and resets the margin to the far

left. This is important, since the typewriter remembers where the left margin was last set, and the margin may not be where you want it. The printer backspace code is arbitrary but should be set to a character you will not need to transmit in normal writing. Form feeds will not work on IBM Selectrics. The underline mode is best used as a continuous underline rather than word-by-word, since you'd have to turn it on and off again after each word.

I never attempt to set margins or tabs using escape codes, although it can be done. It is easier to set them using the word processor. If you use a 10- or 12-pitch ball you will have no trouble, but if you use a proportional spacing ball you will need to use escape codes if you want to change margins or tabs in the middle of a document. Even with the Esc S code to set tabs, it is very difficult to know exactly where the tabs will actually come out in the proportional-spacing mode, since you can only set tabs based on the actual, physical position of the typewriter printhead. This is not easily predictable when you are simply looking at text on a CRT.

Tips and Warnings

If you want the smoothest operation possible, stick to a 10- or 12-pitch type and ignore proportional spacing. If you do use proportional spacing, limit yourself to simple letters without tabular lineup, change of margins, change of tabs, or centering. These features are difficult to implement correctly in a word processing program.

Certain features easily achieved on printers will be impossible on a Selectric. You cannot control type pitch through software, at least not on the Selectric 50 where the pitch is controlled by a lever on the side of the typewriter. The only way to do this would be to send a pause command to the typewriter and change the pitch by hand.

You cannot mix italic, emphasized, double strike, enlarged, condensed, and proportional-spaced type with an IBM Selectric. This could be done only if type



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balls with different fonts were available. As far as I know, these are not available for the Selectric. You can create overstruck characters only if your word processor allows you to send a backspace to the typewriter. Furthermore, you can't send

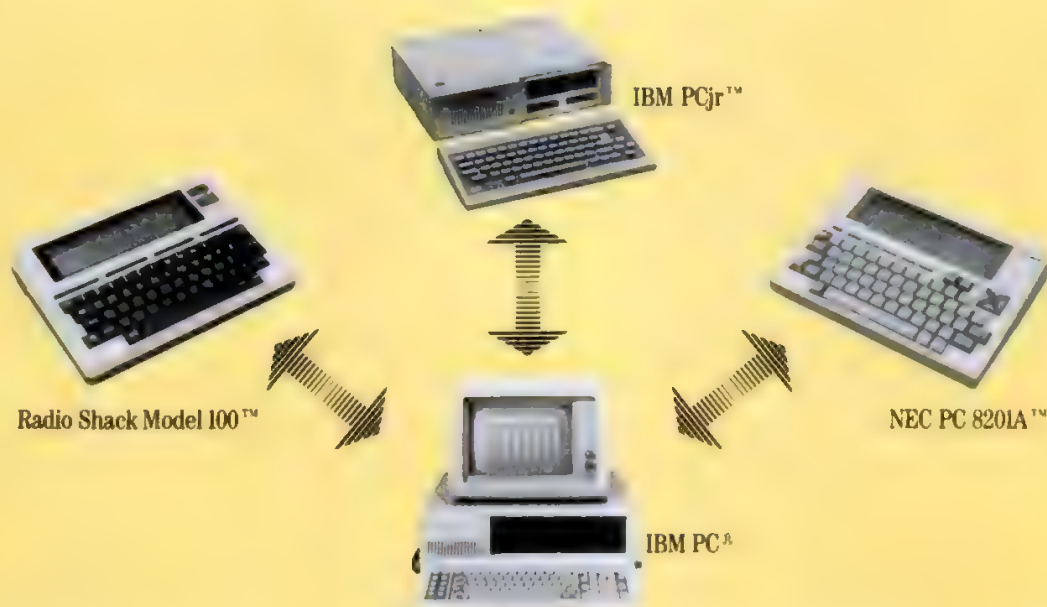
If you are looking for a substitute for a letter-quality printer, you haven't found it in your Selectric typewriter.

half-line feeds to the typewriter, so superscripting and subscripting will take up an entire additional line. Some type balls do include a special, reduced-size, superscript characters 1 and 2. In this case you can send them directly.

If you are looking for a substitute for a letter-quality printer, you haven't found it in your Selectric typewriter. Typewriters make slow, noisy, and somewhat unreliable printers, and they cannot perform many of the tasks true printers can perform. On the other hand, if you already have an electronic Selectric typewriter, the PC-Selectric connection might be worth a try, especially if you plan to use the combination mainly for applications that don't demand high speeds or special features. Be prepared to spend some time on the hardware connection, and on the setup-file modifications in your word processing package. Using the Selectric only for simple printing tasks, and sticking to a 10- or 12-pitch type ball, you stand a reasonable chance for success. ■

Dan Holzman is a registered professional engineer in Oregon, Wisconsin. He has been practicing engineering for 6 years and is now working on a Ph.D in Geotechnical Engineering. He writes frequently for the Madison IBM PC User's Group and is the owner of Galileo Software, an engineering software company.

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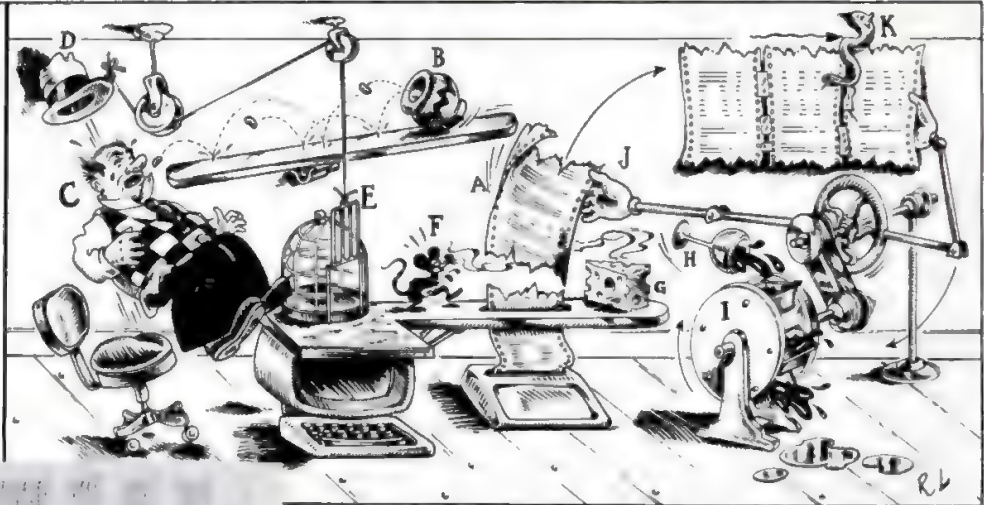
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MUSE, INSPIRED BY SCENT OF PERFECTLY AGED CAMEMBERT CHEESE, GNAWS THROUGH SPREADSHEET, ONLY TO DISCOVER HE HAS BEEN FOOLED BY AROMA OF OVER-RIPE GORGONZOLA (G).

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A Member Of the Ink-Jet Set

Quiet operation and colorful displays characterize Radio Shack's new CGP-220 ink-jet printer for the PC, but it's a far cry from perfection.

Ink-jet printers have always been beyond the economic reach of most microcomputer owners. Recent technological advances are now bringing the prices down and making these machines accessible to home users. One newly

available ink-jet printer is the Radio Shack CGP-220, which, despite some considerable limitations, delivers a pretty good printer for the price.

Microcomputers presently use two major types of printers. Letter-quality printers produce fully formed characters, in much the same way that typewriters do. Dot-matrix printers use a series of tiny dots to form the shapes of the characters.

The advantage of dot-matrix over letter-quality printers lies in their versatility. Since the characters are made up of dots, there are no inherent restrictions on shape

or size. Additionally, print quality can be adjusted by increasing or decreasing the number of dots per character. If the printer software supports graphics, creative users can produce some impressive patterns.

Dot-matrix printers fall into two categories. Impact dot-matrix printers use electromagnets that strike thick wires against a print ribbon, leaving dots on the paper (hence, the term *impact*). Ink-jet printers work by spitting small globs of ink at the paper. Since there is no actual contact between the printer and the paper, ink-jet printers are much quieter than the

Radio Shack CGP-220

Radio Shack Division
Tandy Corporation
Fort Worth, TX 76102
(817) 390-3011

List Price: \$699

CIRCLE 676 ON READER SERVICE CARD



INK-JET

impact ones. Both types of dot-matrix printers run at comparable speeds.

Radio Shack's CGP-220 prints in full color, albeit relatively slowly (38 characters per second), and sells for less than \$700. I recently bought one as a backup for my two other printers.

Installing the New Machine

Hooking up the printer to my IBM PC was simple. The port in the back is almost standard Centronics compatible, so I simply unhooked my Epson printer and plugged in the CGP-220. It worked immediately. Unfortunately, the CGP-220 has no line for initialization. You have to turn the printer off then on again to clear absurd programming.

The printer also has a serial port with settings for 600- and 2400-baud operation, so you don't have to tie up your printer port. The serial port requires special wiring to hook to the PC's asynchronous port, but it isn't hard to figure out. You simply wire three of the pins in the CGP-220's 4-pin DIN plug to their equivalents on the 25-pin adapter on the PC. Then connect the two pins together inside the adapter.

The CGP-220 uses two separate ink cartridges. One cartridge holds black ink, and the other holds three smaller containers of cyan-, magenta-, and yellow-colored ink, respectively. Changing cartridges is a snap; they conveniently plug into the front of the printer.

Operation

A Motorola 6809 processor controls the CGP-220, giving it 8K of EPROM along with 4K of RAM for buffer storage and for the processor.

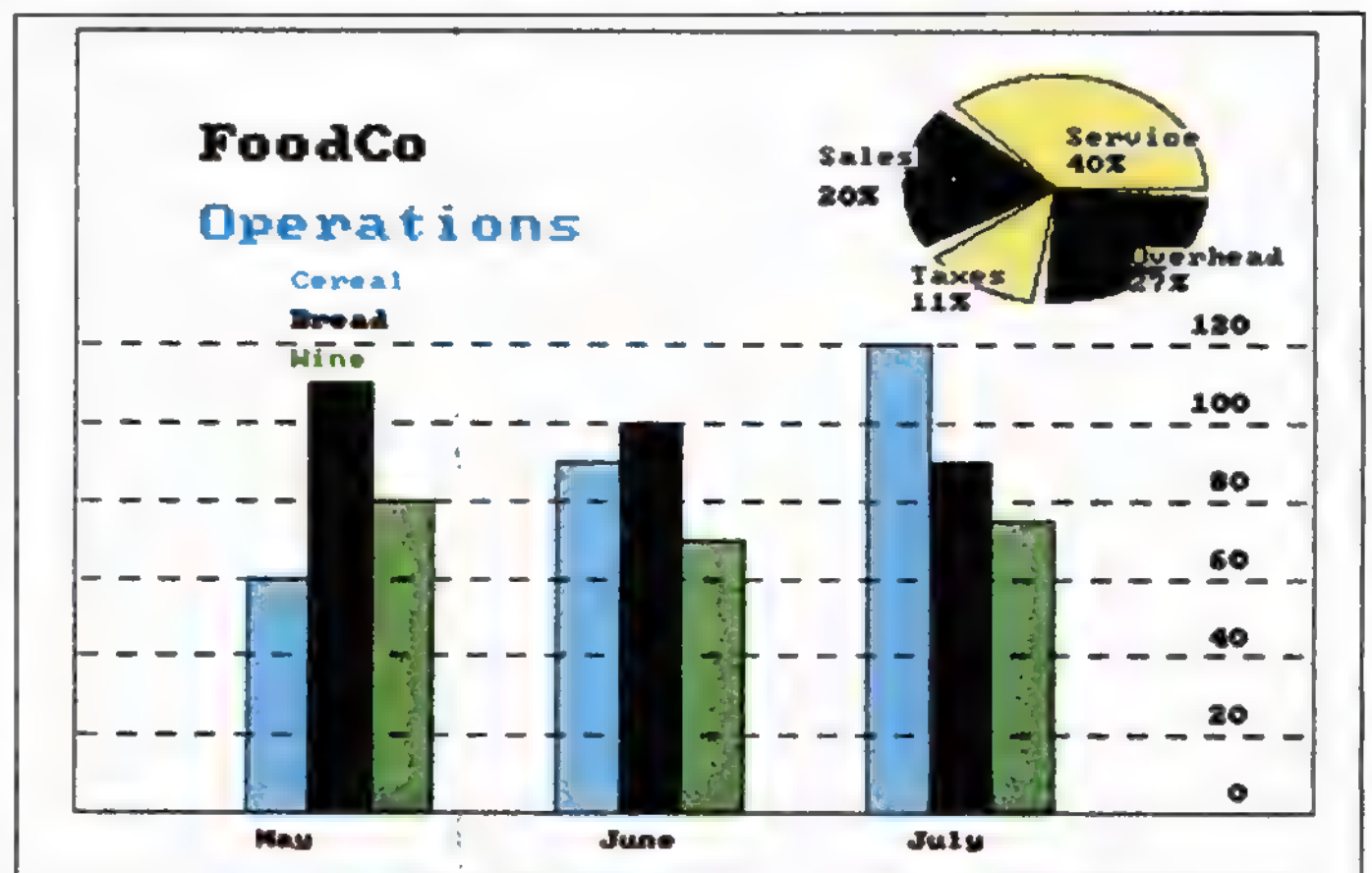
The CGP-220 has four horizontally mounted ink nozzles, one for each color of ink. As the printhead moves back and forth, the nozzles spray multicolored dots in horizontal lines. Since the head has only one row, printing a 5-by-7 character takes seven passes of the printhead, which explains the 38 cps speed rating.

Undoubtedly, and not surprisingly, the greatest advantage of this approach is, of

course, the colors. You can spray colors on top of one another—just like you mix paint. The printer can print up to seven different colors: red, green, cyan, violet, magenta, yellow, and black. In the dot-graphics mode, the CGP-220 can achieve a resolution of 640 dots across the page (or about 80 dots per inch, horizontally and vertically). In the character mode, the

is repeated twice across the screen. The result is a line of only 40 characters.

There is no reverse feed, and there is no way to return to the start of the line without performing a line feed, so you can't underline double-strike characters. The CGP-220's carriage return produces the automatic line feed because the machine prints one horizontal dot (scan) line at a time. By



A sample chart made in the 640x200 mode.

printer's resolution is 560 dots across the page. It creates characters in a 5-by-7 dot matrix inside a 6-by-8 character cell.

The printer accepts rolls or single-sheets and uses the friction-feed method to advance the paper. The roll paper has a special consistency for absorbing the ink, and the results are more distinctive than those printed on single sheets.

Programming

The CGP-220 printer uses an internal microprocessor for control, but its programming is primitive.

The printer has two type styles: standard and vertically compressed. The first is called a 4:3 style, referring to a dot-spacing ratio of four vertical to three horizontal. The second style is called 1:1, since horizontal and vertical spacing are equal. Either style may be printed in elongated print (see Figure 1), where each dot

the time it finishes a row of characters, the printhead is on the bottom scan line of that row of characters. With no reverse feed, a carriage return must return to the top of the next character row. For emphasis, of course, you always have the option of printing characters in different colors.

Limitations

Nonetheless, the CGP-220's automatic line feed imposes severe limitations on the PC. It means that the PrtSc function will cause double spacing. There is no simple remedy for this. Similarly, many word processing programs assume that a carriage return causes return to the start of the same line, so they add a line feed to move to the next line. With the CGP-220, this leads to involuntary double spacing.

Radio Shack could have solved the problem handily by providing a simple switch (software or hardware) that al-

Elongated Letters

ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz
 ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz
 ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz

ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz
 ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz
 ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz

Elongated Letter w/ Standard Pitch (4:3)

ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz
 ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz
 ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz

ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz
 ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz
 ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz

Figure 1: Sample alphabets printed by the Radio Shack CGP-220 ink-jet printer. The top alphabet contains vertically compressed elongated letters, while the bottom one is composed of standard elongated letters.



Figure 2: A 640-by-400 mode, 1:1 ratio, color and dither test pattern.

INK-JET

lowed the printer ignore line feeds.

The CGP-220's characters are not particularly attractive. This could have been remedied by using a denser dot matrix, but the net result would have been a slower printing speed. (If seven scan lines give 38 cps, then 11 scan lines, for example would produce 24 cps.)

Although the character print routines know enough not to go beyond the last character on a line, the graphics routines always shuttle back and forth across the whole line, without respect to the number of pixels you are actually drawing.

None of the printing conveniences you might expect from a modern printer—italics, boldface, underlining, superscripts, subscripts, proportional spacing, justification, reverse feed, fractional line feeds, and downloadable character sets—are present in the CGP-220.

I would hope that, much like impact printers, the programming, flexibility, and features of low-cost ink-jet printers will improve considerably with time. Certainly, one would expect better results considering the amount of available EPROM and RAM on the CGP-220.

Performance

The printer performed exactly as expected. The speed is not extraordinary, but the mechanical operation seems reliable. The colors look good, and the graphics are attractive. Characters are only passable, but I use an impact printer for standard printing anyway, so I can live with this limitation.

Dot-matrix graphic displays often have problems with registration, which means that they cannot properly line up vertical columns. Many printers fail to produce truly straight vertical lines. The Radio Shack's performance was exemplary in this respect: every graphics display looked identical to the screen from which it was printed.

Even when I ran some dither patterns (which simulate an unavailable color by alternating two or more available colors), the dot registration kept the patterns look-



A 640×400 mode color and dither test pattern. All graphics were created using a Tecmar Graphics Master Card, the APL*PLUS/PC language, and a FRIEZE screen dump package, printed out on the Radio Shack CGP-220 ink-jet printer.

ing very respectable and the dots were well defined (see Figure 2).

The printer runs slowly in graphics mode, probably due to the large amount of data being processed. An 8½-by-11 print takes about 5½ minutes to print out. Of course, the pattern is made up of about 400,000 dots, so you really can't complain too much.

Ironically, I have one further complaint that concerns the noise level. Although the printing operation itself is nearly noiseless, the printer makes a noticeable and annoying "thud" every time the printhead returns to the left side of the page. This gets annoying, especially against the otherwise quiet background. But the noise level of the Radio Shack CGP-220 is still much more pleasant to live with than that

of any impact printer.

The Radio Shack CGP-220 satisfies my personal requirements exactly but I would not recommend it as a first printer. You'd be better off with an inexpensive letter-quality printer, which will produce much better quality type at a similar speed, or a dot-matrix impact printer (which will run much faster and still produce better quality characters). Furthermore the lack of an INIT line, the automatic line feed, and the reliance on roll paper, are minor, but annoying, defects. But if you need quiet operation, attractive graphics, and full-color printing, the CGP-220 does a creditable job at a reasonable price. The arrival of the CGP-220 in the printer marketplace is a good omen for the future of inexpensive ink-jet printers. ■

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Tracing PC Machine-Level Operations

The Trace86 utility allows you to observe what the PC is doing at the level of assembly language code. Use it to debug your programs or to learn how the PC works.

The advent of personal computers based on 16-bit microprocessors has put major computing power at our fingertips. *Trace86* is a utility program offered by the Morgan Computing Company of Dallas, Texas, that harnesses this power by showing exactly how the PC runs programs. Technically, *Trace86* is a

Trace86

Morgan Computing Company, Inc.
10400 N. Central Expwy., Suite 210
Dallas, TX 75231
(214) 739-5895

List Price: \$125

Requires: 128K RAM, PC-DOS, one single-sided disk drive.

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debugging tool; by offering interactive access to all PC machine-level operations, it allows programmers to locate and correct errors in software. But *Trace86* is also a powerful learning tool that can permit aspiring programmers to learn how the PC works at the grass-roots level. Besides giving users a better grasp of the PC's *Guide to Operations* manual, it can be used to visualize and learn major portions of the *Technical Reference* and *Disk Operating System* manuals, and even the *Macro Assembler*. BASIC language programmers can also benefit from learning how the PC performs in its native language.

The microprocessor itself has the potential to teach its own operations in the minutest detail. The PC contains a specific

provision for making the microprocessor wait after performing each action: the T-bit status flag, which causes an interrupt after one instruction. *Trace86* uses this single-step capability like a microscope to put the inner workings of the PC on static display. This allows the user to call for the execution of each step at will. Breakpoints are set in the program being traced with the single-byte software interrupt.

Assembly Language Format

Trace86 operates on executable machine-language programs designated with the .EXE or .COM filename extensions. For example, it can be used to explore the operation of the MODE.COM utility program supplied with the DOS diskette. The

TRACE86

INPUT KEY OR COMMAND	FUNCTION
LOAD	READ IN A PROGRAM TO BE TRACED
F2	RELOAD THE LAST FILE LOADED
BR, NBR	SET/REMOVE BREAKPOINTS
BRLIST	LIST BREAKPOINTS
MB, MW	DESIGNATE MEMORY DISPLAY WINDOW FOR TRACE SCREEN (BYTES OR WORDS)
B, W	IMMEDIATE MEMORY DISPLAY
U	UNASSEMBLE & DISPLAY 1 INSTRUCTION
F1	REPEAT FOR NEXT 16 BYTES OR INSTRUCTION
EB, EW	INPUT MEMORY BYTES/WORDS
SETB, SETW	WRITE PATTERN IN MEMORY
SELECT	SPECIFY DISK FILE FOR SAVING OUTPUT OF B, W, AND U COMMANDS
SB, SW	SEARCH MEMORY
CB	COMPARE 2 MEMORY BLOCKS
RD, WR	READ, WRITE DISK SECTORS
REG=	SET REGISTER
IN, OUT	PORT I/O
HEX	HEXADECIMAL ARITHMETIC
COPY	MOVE/LOAD MEMORY BLOCKS
Q	RUN PROGRAM TO BREAKPOINT(S)
R	DISPLAY REGISTER CONTENTS
IP	DISPLAY INSTRUCTION POINTER
G	EXIT TO DOS
8087	DISPLAY 8087 REGISTERS (IF PRESENT)
CLS	CLEAR SCREEN
ENTER	GO TO TRACE MODE

Figure 1: Command screen functions.

KEY	FUNCTION
SPACE BAR	EXECUTE ONE INSTRUCTION
ENTER	CONTINUOUS TRACE EXECUTION
F3	INSTANT REPLAY
F4	TOGGLE HEX DISPLAY UPPER/LOWER CASE
F5	ASCII MEMORY DISPLAY MODE TOGGLE
F6	CONTROL CHARACTERS DISPLAY MODE TOGGLE
D	SCROLL PROGRAM DISPLAY UP ONE LINE
P	PRINT TRACE SCREEN
F	FAST SUBROUTINE EXECUTION
S	SLOW SPEED SUBROUTINE TRACE
C	TRACE LOOP, SIGNAL WHEN COMPLETE
K	COMPLETE SUBROUTINE AT FULL TRACE SPEED
B	DISPLAY MEMORY IN BYTE FORMAT
W	DISPLAY MEMORY IN WORD FORMAT
PGUP, PGDN	MOVE MEMORY DISPLAY WINDOW BY 256 BYTES
CURSOR	DISPLAY ADJACENT MEMORY AREA
ESC	SWITCH TO COMMAND SCREEN
G	EXIT TO DOS

Figure 2: Trace screen commands.

program to be traced is converted to assembly language format, which is the human-readable form of the machine-language code actually executed by the PC's 8088 microprocessor.

Morgan Computing Company supplies the program on a single-sided diskette with a 40-page, indexed manual and a command summary reference card. Four sample programs for tracing are included on the diskette. These are used as examples in the 7-page tutorial that introduces the functions of *Trace86* and explains their uses. The 17-page command reference chapter details the use of each feature, many of which are invoked with the PC function keys.

The final section of the manual presents the theory of operation and program limitations. Some of the limitations are actually warnings to make the user aware of the power of *Trace86*. For example, complete control is available to examine and change any part of the PC's RAM memory, including the *Trace86* program itself!

Entering the command T86 starts the program. A title screen shows the amount of memory available in the computer and the starting address of user memory. It also makes known whether or not an 8087 numeric data coprocessor is contained in the PC. (*Trace86* includes a function to display the contents of all 8087 registers if the coprocessor is present.)

Three screen formats are available: Command, Trace, and Help. The Help facility can be accessed by pressing the F9 key. It provides three full screens of information on the meaning of function keys and other commands and their use. Users can return from the Help facility directly to the Command or Trace screen.

The Command Screen

The Command screen presents a prompt for using a large set of utility commands for program inspection and testing, summarized in Figure 1. A dynamic syntax checker monitors each character of keyboard commands as they are entered.

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Characters representing incorrect command syntax are rejected with a beep. If two consecutive characters are rejected, the screen displays a menu of characters that are acceptable syntax at that point.

Special display commands include R to show the current register contents, IP for the instruction pointer, and 8087 for the numerical data processor microprocessor registers (if present). The user may set the registers and instruction pointer to any desired hexadecimal value by using the Command screen.

Nine address modes are supported, including direct and implicit segment value:offset and 20-bit absolute address. *Trace86* also provides diskette sector numbers and standard file specification formats.

Memory may be inspected and changed and specified areas filled in with an input byte pattern. Individual instructions may be unassembled. The F1 key repeats the previous memory operation for the next 16 bytes or 8 words. The PC keyboard's automatic repeat capability turns the F1 key into a means for quickly inspecting a large memory space. The memory display output may be saved in a designated disk file, and blocks may be transferred between and among memory and files.

Blocks of memory may be compared and memory areas may be searched for specific byte patterns. For example, the release marker date of the ROM BIOS code of a PC with date 10/19/81 may be quickly located at (absolute) address ffff5. This is done by beginning a search of the system ROM at address F4000 as shown in the memory map of page I-2 of the BASIC manual using the command `sb f4000,c000,'10/19/81'`. If this string is not found, the actual date at that location can be checked by displaying the 16 bytes in that area with the B command: `b ffff0`.

Disk sectors may also be read and written directly using the RD and WR commands. Ports, which are the microprocessor's data paths to and from peripheral devices, may be read from or written to

using the IN and OUT commands. The HEX command performs hexadecimal arithmetic, providing both the sum and difference of two specified hex numbers.

The Trace Screen

The program to be traced is loaded from disk and is selected in the Command screen with the LOAD command. If an area of memory is to be displayed with the trace, it is selected using the MB display to

Instructions cause
many things to
change at once on
the Trace screen
display.

show 64 bytes or the MW command to present a format of 32 16-bit words in hexadecimal notation. (For an explanation of MB and MW, see Figure 1.)

Pressing the Enter key then brings up the Trace screen.

The Trace screen offers an array of functions and options (see Figure 2). When initially displayed, a reverse-video cursor is positioned at the first line of the program being traced. Single-step execution is controlled with the space bar of the keyboard; continuous operation begins when the Enter key is pressed. The Esc key is used to return to the Command screen, and function key F9 switches to the Help screen.

The P key also initiates continuous execution and sends the entire screen to the printer as each instruction is performed. The reverse-video bar designating the next instruction to be executed is represented on the printouts by replacing unused spaces on the current line with equal (=) signs. The B and W keys may be used to alternate the memory data display between byte and word format.

In the byte mode of memory display, the F5 key is used to display the memory

contents in ASCII format to the right of the hexadecimal listing. With ASCII displayed, the F6 key is used to select whether ASCII control characters are to be shown as standard symbols or as periods. The control characters should be displayed as periods when printing the screen in order to avoid sending the special meaning of the actual control codes (such as line feed) to the printer. The horizontal cursor arrow keys move the memory display window by one byte. The up and down arrow keys move it by 16 bytes, and the PgUp and PgDn keys relocate the window to the previous or next 256 memory bytes, respectively.

Instructions cause many things to change at once on the Trace screen display. *Trace86* saves the previous trace screen so that all changes can be found and studied. Function key F3 toggles instantly between the current and previous trace screens as many times as desired. (The current screen must be displayed in order to proceed with the stepwise execution of the next instruction.)

Figure 3 shows the Trace screen from a run of the self-starting initial demonstration program. The double-dashed line simulates the reverse-video bar in print, which shows that the sixth instruction will be executed the next time the space bar is pressed.

The two top lines display the contents of the twelve 16-bit registers and the eight 1-bit flags in the 8088 microprocessor. The ax (accumulator), bx (base), cx (count), and dx (data) registers on the left make up the data group. The next four registers are the pointer and index group: sp and bp are used in stack memory operations, and si and di are normally used in moving blocks or strings of memory. The notations cs, ds, es, and ss are segment registers, which define the starting points of various parts of the program being executed. A zero must be added to the right of the segment values shown to designate an actual 20-bit PC memory address.

The eight binary values at the upper right of the registers display are the con-


```

ax 1440 cx 0040 sp 0320 si 0000 cs 1412 es 13e0 b0 d0 i1 s0
bx 0000 dx 0000 bp 0000 di 0000 ds 1415 es 13e0 z0 a0 p0 c0

cs:0000 bB1514      mov     ax,1415      disp 0002
cs:0003 BcdB        mov     ds,ax        disp 0002
cs:0005 bb0000      mov     bx,0000      bx 0000
cs:0008 b040        mov     al,40        off b0002
cs:000a b94000      mov     cx,0040      ds 1415o
1 cs:000d B8B70200  ===== mov ==b [0002+bx],al ===== ea 1415z
1 cs:0011 43         inc     bx          cont 00
1 cs:0012 fec0       inc     al
1 cs:0014 e2f7       loop    000d
cs:0016 be0000      mov     si,0000
cs:0019 bf3f00      mov     di,003f
cs:001c b92000      mov     cx,0020
2 cs:001f B8B40200  mov     b al,[0002+si]
2 cs:0023 86B50200  xchg    b [0002+di],al
2 cs:0027 B8B40200  mov     b [0002+si],al
2 cs:002b 46         inc     si
2 cs:002c 4f         dec     si
2[cs:002d e2f0      loop    001f ]
[cs:002f ebd4       jmp     0005 ]

ds:0002 00 00 61 00 00 00 00 00:00 00 00 00 00 00 00 00  a
ds:0012 00 00 00 00 00 00 00 00:00 00 00 00 00 00 00 00
ds:0022 00 00 00 00 00 00 00 00:00 00 00 00 00 00 00 00
ds:0032 00 00 00 00 00 00 00 00:00 00 00 00 00 00 00 00

```

Figure 3: Trace screen of step 6 in the initial demo program for Trace86. The four instructions in loop 1 will generate 64 ASCII characters and move them to the displayed area of memory. The six instructions of loop 2 will reverse the locations of the displayed characters.

```

ax 1480 cx 0000 sp 0320 si 0000 cs 1412 es 13e0 o0 d0 i1 s0
bx 0040 dx 0000 bp 0000 di 0000 ds 1415 es 13e0 z0 a1 p0 c0   IP=0019

ds:0002 40 41 42 43 44 45 46 47:48 49 4a 4b 4c 4d 4e 4f @ABCDEFGH IJKLMNO
ds:0012 50 51 52 53 54 55 56 57:58 59 5a 5b 5c 5d 5e 5f PQRSTU VWXYZ[\]^_
ds:0022 60 61 62 63 64 65 66 67:68 69 6a 6b 6c 6d 6e 6f `abcdefg hijklmno
ds:0032 70 71 72 73 74 75 76 77:78 79 7a 7b 7c 7d 7e 7f pqrstuvwx yz{|}~.

```

Figure 4: Register and memory display areas after completion of the first loop cs:000d–cs:0014. The next instruction to be executed is cs:0019 (IP=0019). The 64 ASCII characters generated by the program are shown in the memory display.

```

ax 1460 cx 0000 sp 0320 si 0000 cs 1412 es 13e0 o0 d0 i1 s0
bx 0040 dx 0000 bp 0000 di 001f ds 1415 es 13e0 z0 a1 p0 c0   IP=002f

ds:0002 7f 7e 7d 7c 7b 7a 79 78:77 76 75 74 73 72 71 70 .~}|(zyxwvutsrq
ds:0012 6f 6e 6d 6c 6b 6a 69 68:67 66 65 64 63 62 61 60 onmlkjihgfedcba`
ds:0022 5f 5e 5d 5c 5b 5a 59 58:57 56 55 54 53 52 51 50 _^)\[ZYXWVUTSRQP
ds:0032 4f 4e 4d 4c 4b 4a 49 48:47 46 45 44 43 42 41 40 ONMLKJIHG FEDCBAE

```

Figure 5: Register and memory display areas after completion of the second loop cs:001f–cs:002d. The locations of the 64 ASCII characters in memory have been reversed. The next instruction will jump back almost to the beginning and repeat the process.

A Trip to the BIOS

By combining the features of *Trace86*, a programmer can even investigate the PC's ROM-stored input/output code.

```

ax 0600 cx 0000 sp 01fc si 0000 cs 1060 es 1060 eo d0 i1 s0      01fc 0000
bx 7000 dx 1020 bp 0000 di 0000 ds 1083 es 1063 z1 a0 p1 c0      01fe 1060

cs:0000 1e          push    ds
cs:0001 2bc0        sub     ax,ax
cs:0003 50          push    ax
cs:0004 b8b310      mov     ax,1083
cs:0007 8ed8        mov     ds,ax
cs:0009 b90000      mov     cx,0000
cs:000c ba2010      mov     dx,1020
cs:000f b770        mov     bh,70
cs:0011 b80006      mov     ax,0600
cs:0014 cd10 ===== int    10 =====
cs:0016 ba0000      mov     dx,0000
cs:0019 b700        mov     bh,00
cs:001b b402        mov     ah,02
cs:001d cd10        int     10
cs:001f b700        mov     bh,00
cs:0021 b93200      mov     cx,0032
cs:0024 b048        mov     al,48
cs:0026 b410        mov     ah,10
cs:0028 cd10        int     10
cs:002a cb          ret

```

Figure A: The screen following a trace into the PC's system programming in the ROM BIOS. Execution of the interrupt 10 instruction at location ds:0014 will transfer program control to the system.

ax 0600	cx 0000	sp 01e8	si 0000	cs f000	es 1060	eo d0	il s0	01e8	0000
bx 7000	dx 1020	bp 0000	di 0000	ds 1083	es 1063	zi a0	pl c0	01ea	0000
								01ec	7000
cs: f065	fb		sti					01ee	0000
cs: f066	fc		cld					01f0	1020
cs: f067	06		push	es				01f2	1083
cs: f068	1e		push	ds				01f4	1060
cs: f069	52		push	dx				01f6	0016
cs: f06a	51		push	cx				01f8	1060
cs: f06b	53		push	bx				01fa	f346
cs: f06c	56		push	si				01fc	0000
cs: f06d	57		push	di				01fe	1060
cs: f06e	50	*****	push	ax	*****				
cs: f06f	Bac4		mov	al, ah				STACK	
cs: f071	32e4		xor	ah, ah				DISPLAY	
cs: f073	d1e0		shl	ax, 1					
cs: f075	8bf0		mov	si, ax					
cs: f077	3d2000		cmp	ax, 0020					

Figure B: Use of the S command causes the trace to proceed into the ROM BIOS, and initial BIOS instructions save all the registers on the stack. The code being executed starts in ROM memory at location ff065.

The functioning of even the darkest internal corners of the PC can be observed by combining the features of *Trace86*. A trip into the ROM-stored basic input/output (BIOS) code internal to the PC via the S option illustrates the investigative power of the trace.

The first step is to load the code in Figure A. The code comprises a program that clears the screen and then converts the upper left area of the screen to reverse-video display through the video I/O routines of the ROM BIOS. With the program shown in Figure A traced in step mode down to location CS:0014, the S key is pressed by the operator to indicate that the function call subroutine is to be traced completely.

When the int 10 instruction in the figure is executed, the program jumps to the ROM BIOS as shown by the change of the CS register to the f000 base value, which is the start of the reserved memory space area just below the 48K system ROM area. The scene changes completely, and Figure B shows the beginning of the subroutine program. The first thing a good subroutine does is to save the calling program's register values; this is accomplished toward the right of Figure B, where the stack has been built by the series of push instructions.

Trace86 actually executes several instructions each time one step of the user program is processed. In addition to performing the designated function, *Trace86* must update any changes needed to the trace display, memory locations, and the I/O ports.

This is hot stuff, so check your flight manual and buckle your seat belt.—
D.G.

tents of the flag registers, which are single-bit switches used in the microprocessor CPU for conditions such as overflow, the sign of numerical calculation results, and the direction of memory transfer operations.

Loops and Subroutines

Trace86 includes full capabilities for examining or avoiding loops and subroutines at will. Breakpoints may be set to halt the trace or full-speed execution at any instruction. To avoid waiting for many trips through a loop to complete, for example, go to the Command screen, set a

Tracing consists primarily of verifying that the program in fact performs the expected actions.

breakpoint at the next instruction after the loop, and enter g for the GO command. The completion of even a lengthy loop will be announced quickly with a tone.

Multiple breakpoints may be set and listed. They may be individually cleared by address or cleared all at once with a single command.

The C and K commands tell *Trace86* to continue tracing to the end of the programmed repetition of a loop or the running of a subroutine, beep, and then halt. Subroutine execution may be set at fast speed (with no trace) using the F key, or at slow speed with trace using the S key.

Following the Action

The program section of the Trace screen is arranged in four columns. The location or address of each instruction relative to the Code Segment (CS) register is shown in the left-most column. The second column shows the actual machine code for the instruction. The columns on the right contain the assembly-language representation of the instruction, which is

the starting point for using the trace for debugging or studying a program.

The six-line segment at the right of the program area appears when needed to automatically calculate complex memory addresses. When it does, the contents of the lower byte of the ax register (40) are to be moved to the memory address calculated by summing the ds register (14150) with the contents of the bx register (0000) plus the 0002 offset contained in the current instruction. This gives an effective address (ea) of 14152 into which the number is to be moved. ASCII character 40 is the at sign (@), and the result of moving 40 into this memory location is displayed at the end of the left line in the ASCII memory display area in Figure 4.

Tracing consists primarily of verifying that the program in fact performs the expected actions. For example, the first instruction shown in Figure 3, mov ax,1415, instructs the CPU to move the value 1415 into the ax register. The second instruction moves this value from ax into the ds register, where it can still be seen (center of the second line) even though later steps have modified the contents of the ax register.

The sample program in Figure 3 generates 64 (hex 40) characters and stores them in memory one by one, starting at the location designated by the data segment register, which currently contains 1415. The memory display feature has been set up to show this area at the bottom of the Trace screen so that the appearance of the ASCII characters can be observed. The third instruction, mov bx,0000, zeroes the bx register in preparation for indexing through the addresses where the successive characters are to be stored. The cx register is then loaded with hex 40 and is automatically decremented to zero to control the number of times the loop of program steps from cs:000d to cs:0014 is executed.

In the trace operation, the reverse-video line traverses the loop as each instruction is executed and each ASCII character appears in memory, one per loop. The

TRACE86

character generated is changed for each loop by incrementing the low byte (al) of the ax register with the instruction at cs:0012. The current instruction of Figure 3 is cs:000d; *Trace86* generates an analysis of the addressing scheme of such complex instructions as shown on the right of the figure. The displayed section of the program scrolls, so that the previous and next instructions are always in view. The entire program may be incrementally scrolled up one line at a time with the D key.

Figure 4 shows the register and memory contents after the 64 loop passes have been completed and the 64 ASCII characters from hex 40 to hex 7F have been placed in memory. The right two hex digits of the ax register have been incremented up to 80 (ready to generate the next ASCII character, if desired). The cx

register has been decremented to 0, which terminates the first loop. The upper right corner of Figure 4 shows a special printout of the current (I)nstruction (P)ointer (reverse-video bar) location. From Figure 3, it can be confirmed that by IP having reached location cs:0019, the program has completed the first loop (which ends at cs:0014) and advanced beyond it. The two instructions shown in brackets at cs:002d and cs:002f scroll into the display after the second loop completes.

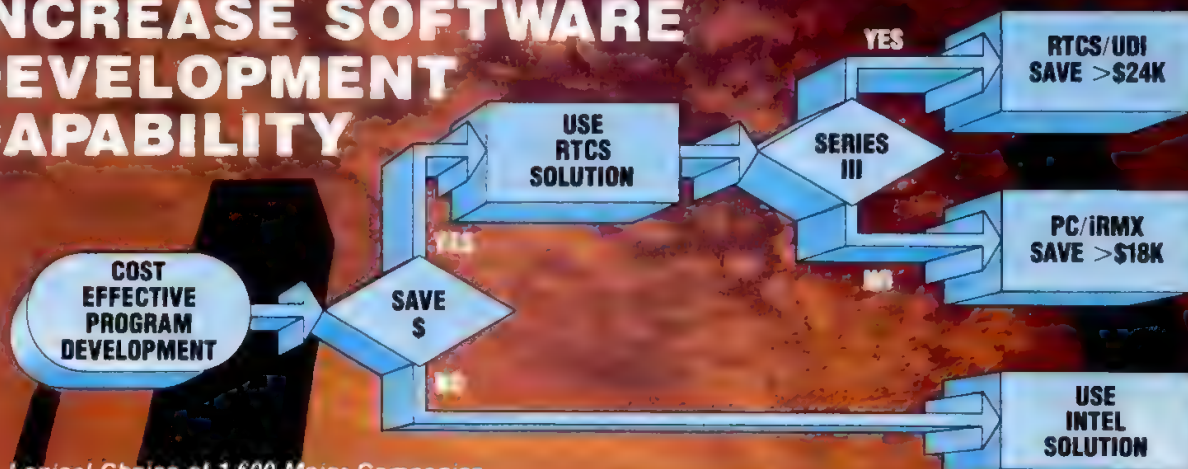
The second loop, cs:001F-002D, reverses the order of appearance of the ASCII characters in memory. Its results are shown in Figure 5, along with two additional instructions that are scrolled into the field of view when they are executed. The instruction at 002d is the end of the second loop, and the jmp 0005 instruction at the end starts the process all over

again. Figures 3 through 5 show the results of about 650 instruction executions.

Using *Trace86* starts out as an adventure into the inner workings of the PC. For experienced assembly-language programmers, it puts the power of the PC on your side in achieving excellence in program performance. Those interested in learning how to harness the PC in its native language will find themselves joining the action as each instruction is displayed and learned step by step. *Trace86* lets you direct your own progress in mastering the use of the tool for modern times. ■

Dick Gall publishes a consultants' directory, Dallas Computes. He is also a columnist for Star Text, a local database service offered by the Fort-Worth Star Telegram.

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A Switch-Hitting Portable

The chameleon is a portable computer whose 8088 microprocessor, with its Z-80 chip, can run both DOS and CP/M. Unfortunately, its compatibility batting average isn't that high.

A chameleon is a lizard that changes color to match its environment. Seequa's "Chameleon" is a portable computer that does something similar; it changes its processor to match the environment of its application. The standard Chameleon is an 8088-based portable computer with a Z-80 chip tucked inside. This means that it can run programs written for CP/M (which uses the Z-80 chip) and for DOS (which uses

the 8088). In other words, Seequa has produced an IBM-compatible computer that can also run programs under the CP/M-80 operating system.

The Chameleon comes with 128K RAM and two single-sided disk drives and sells for \$1,995. Additional memory and double-sided drives are available separately or in a standard version called the Chameleon Plus, for \$2,895.

The Chameleon comes in a case measuring 8-by-18-by-16 and weighs in at 26 pounds; it is clearly a portable computer that can compete with the best of them. It comes with the *Perfect* family of software (*Perfect Calc*, *Perfect Writer*, and *Perfect Speller*), Microsoft BASIC, and MS-DOS. (GW BASIC and CP/M-80 and CP/M-86 are available as options and are standard on the Chameleon Plus.)

Since it is also CP/M-80-compatible, it has the potential to become an exceptionally versatile machine, particularly for users who work with one operating system at the office and use the other at home.

Chameleon in the Hospital

This review is based on a Chameleon purchased by North Arundel Hospital in Glen Burnie, Maryland. The hospital had neither CP/M-80 machines nor IBM PCs in use. It wanted a portable tool with word processing and spreadsheet capabilities for use in its data processing department. The Chameleon was chosen because its standard features offered the most cost-effective match for the hospital's requirements.

The hospital is pleased with the Chameleon's performance so far. The system

The Chameleon

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documentation was clear enough that an inexperienced user could turn on the system and boot DOS. An operator with limited DOS experience easily installed the spreadsheet and word processing packages.

I was called into the hospital as an informal consultant by a friend who was testing the new equipment. Our first step was to see just how compatible the Chameleon and the IBM PC really were. The hospital users of our test system were not concerned with this. Their primary interest was in packaged word processing and financial capabilities.

Nonetheless, we experimented with commercially prepared BASIC and machine-language programs, several non-DOS programs (games), and numerous public domain software packages. We were also interested to see if the Chameleon offered any unique possibilities for program development. There were several questions that we wanted to answer: Could the Chameleon read and write disks created with an IBM PC? Could it create a disk that would run on a PC? Could it execute BASIC and machine-language programs written for the PC? We also investigated how well the Chameleon could make use of peripherals designed for the PC. Although the Chameleon lacks expansion slots, the results were about average for IBM compatibles.

On the Same Level

As long as both machines were using the same version of PC-DOS, disks from one machine worked perfectly on the other. We created user disks for PC-DOS 1.1 on the Chameleon and an IBM PC and prepared some simple files using EDLIN. These disks could be used interchangeably without problems. The *Perfect Writer* and *Perfect Calc* user disks created for the Chameleon worked quite well on the PC. Files for these programs produced by one machine were readable on the other. Most notably, a DOS 2.0 system disk that included ANSI.SYS with several keyboard redefinitions worked just as well on

the Chameleon as it did on the PC. In fact, all the IBM utilities delivered with the operating system, except BASIC, appeared to work interchangeably on either system.

The same was true for commercial packages, with a few wrinkles. Non-BASIC programs such as *WordStar*, *VisiCalc* (64K), and *dBASE II* all performed as expected. We were able to execute all of the lessons in Lotus' *1-2-3* tutorial. But the IBM *Asynchronous Communication* package and *PC-Talk*, both written in BASIC, failed. So did the demo disk for *The Creator*, which also contains some BASIC segments.

We noticed a sensitivity to program size. Some programs advertised as requiring 128K would not run on the Chameleon under DOS 2.0. They ran fine on the smaller version 1.1. The IBM PC also exhibits this peculiarity with *VisiTrend/Plot*, for example. However, this program would not load in the Chameleon under either operating system. It continued to behave as it did when trying to load in an

IBM PC without enough memory.

The Chameleon dealer was careful not to claim that the *Visi* series or any other program not distributed by Seequa would run on its machines. Apparently, the company is testing as many of the major commercial packages as possible and will encourage software publishers to advertise Chameleon compatibility or make available special versions.

It is unlikely that Seequa will have the resources to test all of the public domain software now available for the IBM PC. We spent several long evenings testing just some of these available. We found that, like the commercial software, machine language works; BASIC does not. *PC-File* and most of the game programs we tested failed. Most of the machine language utilities worked, but a few, especially those that were sensitive to operating system version, failed. It is probably safe to assume that commercial programs are designed to reach the widest possible audience and tend not to contain features that make them incompatible with the



The Chameleon portable computer contains both Z-80 and 8088 microchips and runs programs written under both CPM and DOS.

Chameleon or other IBM workalikes.

The clearest example of the difference in compatibility between machine language and BASIC was provided by the *FriendlyWare* introductory package. Its cleverly animated introduction, provided as a .COM file, worked perfectly. But all of the BASIC programs that followed aborted with syntax errors. The standard Chameleon BASIC does not support many extensions provided in IBM's BASICA, so these commands generate syntax errors. Although both interpreters were written by Microsoft, they use different internal representations for some commands. For this reason, even BASIC programs that do not use advanced features can't be transferred unless they are stored in the ASCII format.

Writing Programs

Microsoft BASIC is often the language of choice for writing programs on a personal computer. It does not have extensions for graphics, music, and display control, but it does have all the capabilities we have come to expect from Microsoft, which include sequential and random disk files, complete string handling, scientific-function library, multicharacter variable names, and multidimensional arrays.

Writing them on the Chameleon is nearly as easy as on the IBM PC, however. The fault lies not with the computer, but with the editor. I am accustomed to moving the cursor all over the screen to make corrections and to seeing the effect of changes (characters inserted and deleted, for example) as they are made. The editor used in the Chameleon's Microsoft BASIC is much like EDLIN in PC-DOS. Changes are visible only in the portion of the line that has already been accessed, and only the current line is available for editing. I missed the capability to edit listed program lines and to see the entire line called by an EDIT command.

There is hope for improvement, though Chameleon's BASIC is loaded from disk and does not reside in ROM. This will allow Seequa to easily upgrade to a more

powerful BASIC. In fact, it has just acquired a license to adapt GW-BASIC, the Microsoft program that spawned BASICA. It will be sold as an option on the standard Chameleon and as part of the Chameleon Plus package. This version will support all the graphics and music

The Chameleon is
clearly a portable
computer that can
compete with the
best of them.

extensions provided by IBM in BASIC 2.0 and provide the editing features I now enjoy on the PC. It will soon be commercially available.

BASIC and PC-DOS were not the only aspects of IBM compatibility we considered. Among the hospital's application packages was an extensive medicare reporting package run under CP/M-86. Developed specifically for the IBM PC, it ported fairly easily to the Chameleon. The major difficulty we encountered was preparing a copy of the package that could run on the Chameleon's single-sided drives. The same problem would occur on an older model PC; upgrades to double-sided drives are available through Seequa and their dealers, so this is not really an incompatibility problem.

We also checked the compatibility of copy-protected games such as *Zork* and *Night Mission Pinball*. Both of these ran on the Chameleon, but with a peculiarity: both check for a monochrome display adapter, and both decided that the Chameleon had one even though it doesn't. As a result, *ZORK* did not offer the option of color, and *Night Mission* failed to display its instructions and customizing menu. (Presumably these were directed to the nonexistent monochrome adapter display memory.) *Night Mission* did produce all its graphics once the correct commands were entered (blindly), including color via

RGB and composite outputs. These programs and others like them are definitely playable, but the Chameleon owner should check for such snags before buying them.

Powerful OPTIONS

The game programs had actually discovered a previously undocumented feature of the Chameleon. We had tried various diagnostic programs and BASIC PEEKs and POKEs to determine how Seequa keys the computer for display types, but we figured it out only after Seequa released a program called *Options*. In place of the PC's set of switches that must be set to show which display adapter is installed, the Chameleon has a block of nonvolatile RAM. This convenient feature allows the system to be configured without opening the case. The *Options* program alters the settings in this block and tells the operating system whether the user wants to generate color or black-and-white display information. It eliminates the unreadable displays that result when color characters are shown on an amber or green-phosphor monitor. Unfortunately, neither the game programs nor PC-DOS know how to correctly interpret the nonvolatile RAM. This appears to be a problem, but it may turn out to be a blessing in disguise.

The problem lies in how powerful the *Options* program really is. In addition to changing the display format, it specifies the system RAM size, sets the number of serial and parallel ports, and alters the color palettes. *Options* also allows permanent redirection of printer output to a serial port, and console control to either a serial or parallel port. A careless user can get into trouble here. If he redirects console control to a port with no active input device, MS-DOS cannot obtain the commands needed to set it back to the keyboard and display. Worse yet, the settings are electrically encoded in the computer, so rebooting, even with a new copy of the operating system, will not help. Fortunately, PC-DOS ignores the settings and

always boots with the standard console devices. *Options* can run under PC-DOS and restore the default console so that MS-DOS can be used again. Seequa claims to be shipping a new version of *Options* without the console redirection capability, but we strongly recommend that Chameleon owners find a copy of PC-DOS, just in case.

While PC-DOS appears to be almost a necessity, other IBM system software, for example the diagnostic and communications packages, are almost useless on the Chameleon. Like the game programs, the diagnostics claimed our Chameleon was equipped with two display adapters. The program correctly found the keyboard, 128K RAM, two disk drives, and a parallel port, but it failed to find the serial port. Only the keyboard, disk drive, and printer diagnostics ran successfully. System unit and display tests all failed. Since diagnostics are by nature machine specific, it should be considered a plus for Seequa that the IBM PC diagnostics package works at all.

Serial Port Problems

The lack of compatibility in the serial port can cause problems, though. Our Chameleon was delivered with a serial port, but the IBM diagnostics failed to locate it, and, therefore, did not try to test it. The retailer supplied the hospital with a communications package, but even that didn't solve the Chameleon's serial port problems. When we attempted to connect a Hayes Smartmodem, we discovered that Seequa uses a female output connector instead of the male connector used by IBM. Thus, the Chameleon cannot use IBM style cables to connect to serial devices. Seequa says that the serial port differences are deliberate. The Chameleon's serial port is designed to support synchronous as well as asynchronous communication and uses a different circuit than the IBM PC. Both the circuit and connector differences were planned to facilitate networking. This is a possible plus for future applications, but a definite

minus for compatibility.

Another difference became apparent as soon as the machines were turned on. Because BASIC resides in ROM, the IBM PC can be used without loading a disk. The Chameleon, on the other hand, must

Our Chameleon was delivered with a serial port, but the IBM diagnostics failed to locate it.

have a disk in drive A. Without it, the machine begins executing a low-level monitor routine with commands vaguely similar to DEBUG. An experienced user could use the monitor to debug his system after a crash, or to bootstrap nonstandard software. Because the documentation is so skimpy, however, less seasoned users should load a disk and reboot.

The lack of documentation on features such as the "no disk" monitor has been Seequa's major shortcoming. As mentioned earlier, our test machine was delivered with PC-DOS and its accompanying IBM manual. This guaranteed good documentation on the operating system, but a Seequa-produced binder included with the machine consisted almost entirely of Microsoft's BASIC manual. There was barely enough Chameleon-specific material to turn on the machine and connect the keyboard. For the hospital users who wanted to run only packaged applications, this was sufficient to allow the *Perfect Calc* and *Perfect Writer* documentation to take over.

Just before presstime, however, Seequa published revision 2.0 of its manual. It improves the original by adding illustrations, instructions for running MS-DOS (replacing PC-DOS) *Perfect Calc*, and *Perfect Writer*, and a series of technical appendixes. The technical data include I/O port locations and pin outs, a memory map, BIOS entry points, and documenta-

tion for several unique, Chameleon-oriented utility programs. We got the help we needed to cable the serial port to our modem. The material is still far short of the standard set by IBM, but sufficient for an experienced hobbyist to make the Chameleon live up to its potential.

CP/M Compatibility

Compatibility with the IBM PC is only half the story. The other half is its compatibility with CP/M. We know that the Chameleon will run CP/M-86. Selecting MS-DOS or CP/M-86 is simply a matter of which operating system is on the diskette in drive A when the system is turned on. The dealer told us that loading CP/M-80 would be just as easy, but the package was not available at presstime. With a little inside information from Seequa, however, we can predict the extent of the Chameleon's CP/M-80 compatibility.

The Chameleon's Z-80 does nothing until CP/M-80 is booted. Then it uses the 8088 as an I/O processor to pass programs and data between the Z-80 and the outside world. This arrangement provides compatibility with schemes that allow the IBM PC to run CP/M-80 programs using an add-on Z-80 processor card.

I would imagine that since the 8088 handles the I/O, Chameleon CP/M-80 disks must be in CP/M-86 format. This allows sharing between 8- and 16-bit environments, but makes the Chameleon incompatible with existing CP/M-80 mini-floppy systems. Before a user would be able to use files from his home computer, he would need to run them through a file conversion utility program. After these conversions, the Chameleon should be as compatible with a given CP/M system as the IBM PC would be, if it were equipped with a Z-80 processor card. The guidelines we found when comparing the Chameleon and IBM under DOS should also apply. Programs that utilize machine-specific features, or that rely on ROM-based software, will fail. BASIC programs probably won't work, either. Commercial, machine-language programs should run with-

PORTABLE

out modification, but results with public domain software are likely to be less certain. Put simply, the Chameleon is about as compatible with a generic, Z-80 based CP/M computer as it is with the PC.

A Throwback

In regards to both IBM PC- and CP/M-compatibility, the Chameleon's realization cannot quite live up to Seequa's promises. This is more a result of a lack of user support than of inherent limitations in the hardware. When microcomputers were first made available to the public, many companies rushed into production with innovative hardware but neglected the software and documentation to support their products. Seequa has started out as a throwback to those days. Generally compatible with the IBM PC, it has tapped into a sizable software resource, and purchased

well-documented, user-friendly packages to include with its product. Unfortunately, the company stops there.

Seequa is trying to change its image. Improved documentation and system soft-

Seequa says that the differences are deliberate.

ware (for example, the *Options* and communications packages mentioned earlier) will be given to existing owners through the dealer who originally sold them their machine. The change to GW-BASIC will certainly improve the IBM PC-compatibility problems. Seequa is even installing a technical support hotline and an electronic bulletin board.

If, like North Arundel Hospital, you need a low-cost portable computer to place spreadsheet capability at a user site, the Chameleon might do the trick for you. If you need both PC-DOS and CP/M-80 capabilities and are an experienced microcomputer user, the Chameleon could be an effective alternative to buying two computers. However, if you need more than prepackaged, Seequa-supported software and hardware and are not a computer professional, perhaps you should overlook the Chameleon in the jungle of other microcomputer choices. ■

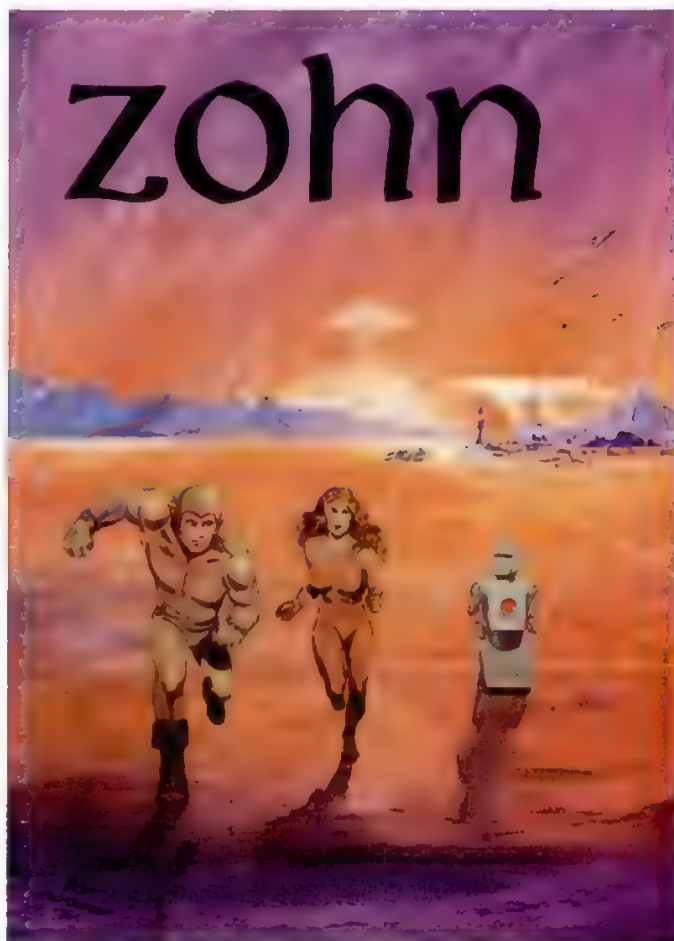
Stephen P. Smith is a manager of computer system development for HRB Singer Inc., a computer system contractor for the United States Government. He lives in Severna Park, Maryland and has written for Byte and Personal Computing.

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If you watch television, you've probably seen the advertisements for the Airborne Freight Corporation. A lean man holding a package and wearing an Airborne uniform jogs past other uniformed men representing the company's competitors. It is an image of a company constantly in motion.

That ad is also an apt metaphor for the entire priority delivery industry. Following an Airborne package during a typical 24-hour period (see "The Airborne Journey Of A Package" in this issue) one emerges with the impression that the entire company, from managers to truck drivers to sorters, is always in motion. It is an industry best characterized by John Calabro, director of Airborne's Wilmington

Center: "Everybody wants their package picked up last and delivered first. That's how we're going to make our money."

The Stakes Are High

The amount of money at stake is not inconsiderable. Stuart O'Steen, public relations specialist for Airborne, estimated that American businesses will spend \$3 billion this year to ship packages ranging from a few ounces of memos or contracts to muscle-wrenching crates of machine parts weighing hundreds of pounds.

It is an intensely competitive industry, said O'Steen. There are more than 2,000 shippers fighting for a slice of the market. Large-volume customers traditionally receive negotiated discounts that can save

the shipper as much as a third of the delivery price. In the autumn of 1982, as part of its promotional efforts, Airborne began offering its larger customers and IBM PC to automate the mailroom as well as to allow customers to keep track more easily of the packages' routes.

"We believe we are fairly unique in the industry because we have more personal computers out there than anyone else," said O'Steen. "We developed the software ourselves and our system is the most extensive." Airborne and the customer share the estimated \$4,500 cost of the set-up according to a formula negotiated by the parties, said O'Steen.

"The computer is an important part of what we can offer our volume package

accounts," said senior account representative John Paul Bunvan. "When an account asks, 'What else can you do for me?' we answer that we can automate their mailroom."

"We're finding that the program is very popular," said Donald G. Smith, an Airborne district sales manager, who estimated that half a dozen companies in his New York City territory are already involved. To the customer, the PC represents a savings in operating costs as well as tighter control of its delivery system, he said. "It helps productivity savings in the mailroom when you're handling 50 to 100 billings a day. To prepare those bills used to take several man-hours a day. Now each one takes maybe 6 or 7 seconds."

"It's easier than doing it by hand," agreed Vivian MacField, a clerk at the American International Group (AIG), as she typed a package's destination into the system. "I find that I am less tired when the day is over."

Easy to Use

MacField, a computer novice, said that Airborne's menu-driven program is easy to use. The main menu offers such options as preparing an airbill for a package or express mail and correcting an erroneous label. After choosing to create a label, for example, the operator punches in the destination and the weight of the package. Other needed information, such as proper numbering, the sending company's address, and billing codes, is already written into the program. In less than 12 seconds, the printer automatically makes three copies, including the actual mailing label that is attached to the package. One set stays with the shipper for that company's records; another set goes with the package and is used by Airborne as part of its billing system.

"About 10 to 15 percent of the billing comes from companies with computers like AIG," said Frank Greco, the inside lead agent at Airborne's Kennedy Airport office in New York. "The big advantage for us is that it is easier to read the data."

All of the parcel sorting is done by hand, and the clarity of print also helps to cut down on errors.

Though the whole delivery system is based on computers, much of the work is still done manually. For example, typists

After choosing to
create a label, the
operator punches in
the destination and
the weight of the
package.

transfer the information from the computer-generated bills into IBM terminals connected to the company's main computers in Seattle, Washington. As the codes go into the main computer, they are used to compile lists of which packages should arrive the next morning at which distribution warehouses. By 3 a.m., the main computers begin printing manifests at the approximately 100 distribution centers around the country and list all the packages that will arrive in the next few hours from the sorting center in Wilmington. The manifests are then checked against the received shipments so that lost or misplaced packages can be traced.

A Selling Point

The tracing system helped sell AIG on Airborne, said mailroom supervisor Florence Ukson. "It's an excellent trace service," she said, estimating that AIG uses it for an average of two packages a month. Using an Airborne-supplied modem program, a customer can call up a communications menu. After the customer selects from such options as start communications, restart communications (in case of an error), and a diagnostic program, the screen displays an airplane with a thank-you message (the only graphics in the package). Below the airplane is a prompt line asking for the package number. Once the number is punched in, the

main computer will display the package's source, whether it arrived at a central shipping point, whether it arrived at the destination's central distribution point, and finally, whether it has been delivered. All of that information is manually punched into the computer system as the package wends its way to its destination.

In addition to routing information, the main computer system also uses the information from the individual shipping orders to prepare bills. Included in a company's billing code is the amount of deduction, depending on the volume of cargo a customer generates, said Frank Greco. The amount of the discount will vary, but it can be several dollars off the \$12.45 base rate for small packages, he said.

"At the end of the day, the computer will also give you a summary of that day's activities," said Donald Smith. That usually involves further savings for the shipper, who does not have to prepare such reports manually. Airborne also operates a system of computer terminals for some customers, but a microcomputer has more flexibility. "The mailroom can take advantage of the PC for uses other than express traffic," said Smith. "What often happens is that a mailroom can't get the authority to buy a computer, and this is an easy way for them to get a PC."

Exploring New Uses

At present, the AIG mailroom, which has had the computer since June, uses it only for shipping packages, though the company has begun to explore such other uses as preparing reports and budgets. "We just haven't had the time to do the programming yet," said Florence Ukson. Though the company has had the computer since June, "we would like to put the payroll and the internal hours that people work on it."

The computer has had an immediate impact. Of the ten AIG employees who are attending school, nine have decided to study computers, Ukson said.

AIG is one of about 45 companies

across the country for which Airborne has installed an IBM PC. Most of the companies are located in the Northeast, said Lee Bordenet, Airborne's systems group manager.

Three companies, Federal Express, Airborne, and Emery Worldwide, represent about two-thirds of the priority delivery industry.

ager for data processing. "We now install about one PC every 2 weeks," he said. "I see the program going on indefinitely. We haven't had any customers say they don't like it or ask us to take it away. All of them seem quite happy."

"We began considering this a couple of years ago, he said. "We wanted something that would automate the description of freight and that would be easy to use." Bordenet said the choice of the IBM PC was natural, because "we have a lot of IBM equipment and there is a tendency to go with a product that you are familiar with. We've got IBM programmer-analysts and we use an IBM program editor on our mainframes. It saved us a lot of trouble. For one thing, IBM is all over the country. It's never a problem getting parts. We needed something reliable because the computer has more strenuous usage than it would get at home."

Hardware and Software

Airborne shipped its first PC more than 14 months ago, Bordenet said. The PC comes with 128K RAM, and two disk drives. There is an internal board for memory expansion, another board connects the PC to a 300 or 1200 baud Ventel MD 212 Plus II modem. There is also a connection to a DS-120 dot matrix Data-south printer that is rated at 180 characters per second. The printer was chosen

because it works well on multi-part forms, Bordenet said. He estimated the total hardware cost at \$4,500. The software was written in COBOL because the programmers had the most experience with the language and use it for the mainframes. The modem program allows the PC to emulate a fixed terminal, said Bordenet.

"We don't supply any extra software," he said, "but we have been supplying enhancements. The most recent one is a batch printing option, so that if a customer sends a large amount to a particular address, say every Tuesday, the printing can be done in one shot."

Airborne handles the installation and supplies support services and training. "We'll get a lot of questions for a few days after training," he said. "Typically, the machine is used on different shifts, so one of our programmer-analysts will have to lead various employees through the menus. Occasionally we get a call about a hardware problem. The customer can then ship the machine back here for repair and we'll send out another machine. The whole program has been pretty enjoyable for people involved here."

Three companies, Federal Express, Airborne, and Emery Worldwide, now represent about two-thirds of the multibillion-dollar priority delivery industry, said Airborne spokesman O'Steen. Federal Express is the overall leader by far, with an estimated one-third of the billings. According to Armand Schneider, Federal Express' manager of media relations, the company delivers about 236,000 parcels a night, compared to the 40,000 or so parcels that Airborne handles. The number three company, Emery Worldwide, is the leader in the over-70-pound package class, said Bob Sykes, Emery's director of corporate communications. All three companies operate on the hub principle, shipping all their cargo to a central distribution point where the packages are sorted and then reshipped for delivery the next day. Centralized sorting is cheaper in the long run than sorting packages when they are first picked up.

The Computer Competition

"Almost all companies have been offering some type of computerization for a while," said Emery spokesman Bob Sykes. "We offer terminals and a printer to print out all of the manifests. The terminal also helps to keep track of where the package is going." He said that Emery also offers personal computers but he had no details. Federal Express has offered microcomputers as well as terminals, said spokesman Armand Schneider. "We are doing it on a limited basis for package-tracking and billing," he said. He denied that the program was in response to Airborne's campaign. "We have been looking at it for some time," he said. Because the program is still being studied, he refused to give more details.

Airborne's system is not yet sophisticated enough to have its main computer receive billing information from the customers' PCs. As far as tracing is concerned, the system still depends on typists punching information into the main computer, rather than using light codes to read a package, for example, a technique used by operators of automated cash registers in supermarkets. "Right now," said Bordenet, "we have a study in progress by a consultant who is looking at all of the new technology that is available, exploring what potential there is and how it can be applied, with thought to redoing the whole system to include whatever is beneficial. Anything and everything is being considered."

"Using the computer has made everything easier," said AIG's mailroom supervisor Florence Ukson. "With 150 airbills a day, it used to take three people to prepare the airbills each night. With the computer it isn't any problem. Whatever delivery contract we negotiate in the future with whatever company is going to have to include a computer."

"I'm not willing to give it up," she declared. It wouldn't be worth it. ■

Michael Muskal is a New York City-based freelance writer.



The Airborne Journey Of A Package

As a package travels by air and land from New York to Boston via Airborne Freight Company, its circuitous path can be traced with a PC.

The sun never shines on the narrow streets that wind through New York City's Wall Street, the most important financial district in the nation. At 7:30 a.m., the stocks, bonds, insurance, and corporate headquarters are just beginning to fill with employees who will generate enough paper to cover the 110 one-acre floors of the World Trade Center. Many will have to be sent urgently somewhere else. It doesn't really matter whether it's across the country or just across the street. The point is that they must be moved—dependably and quickly.

The Journey Begins

2:30 p.m.—The “urgent” pieces of paper begin moving in mailrooms much like the one at the American International Group (AIG) at 70 Pine Street. That company, with 4,000 New York employees working in four buildings, spends more than \$1 million a year in postage and perhaps half that again in special express delivery using carriers such as Airborne Freight Corporation, which handles 50 to 150 parcels daily from this one firm. The AIG mailroom is surprisingly small. About 300 feet long, and no wider than 50 feet, the room is crammed with 51 scurrying employees. Tucked into a corner, behind a short partition, is a desk for supervisor Florence Ukson. A few feet away from her is an IBM PC.

The PC plays an important part in Airborne's ambitious marketing plan, the ultimate object of which is to challenge Federal Express for the number-one ranking among package couriers (see “The PC Flies High With Airborne,” in this issue).

Today one of the packages that will be sent through the Airborne system is destined for an AIG affiliate, Lexington Insurance on Federal Street in Boston. The Boston-bound package is handed to clerk Vivian MacField, who sits at the PC and boots up the first menu of options. From here, an operator can automatically prepare an airbill according to the different standards for various types of packages,

prepare summaries of the airbills, or track a package as it moves through the Airborne system.

5 p.m.—Packages begin arriving in a stream that slowly grows into a torrent. Because of the flow of business, most of the mail and express delivery parcels tend to bunch up at the end of the day, usually immediately before pickup.

With a wave and a smile, 40-year-old truckdriver Larry Saccomanno wheels his trolley into the mailroom. He is a familiar figure in his uniform with the red-and-white Airborne patch. Each morning, he drops off that day's deliveries; each evening he runs his route in reverse (about 35 stops) to pick up the outgoing mail. "It's how I stay in shape," jokes Saccomanno, who has worked 12-to-13-hour days for 15 years.

Headed for Boston

As Ukson continues punching out labels, Saccomanno examines the address on each letter and package. Then using a black marker, he codes the parcel according to destination. The Lexington Insurance package gets a "BOS 4B," signifying that it will go to Boston, which is coded 4B. It is in the coding that an air freight company is made or lost, said John Paul Bunyan, an Airborne senior account representative. A wrong code now means difficulty in sorting later.

6:01 p.m.—The packing is finished. Each piece has been coded and laid into one of 12 cardboard shipping boxes that are piled on the hand trolley. The shipping boxes are then brought out to the waiting truck. With all the workers helping to load the truck, the Boston-bound package is finally placed safely aboard for the 30-minute rush hour drive to the company's Queens warehouse.

The First Leg

6:42 p.m.—Saccomanno turns onto 13th Street in Queens and enters the cavernous warehouse with a wave to Joe Hanley, the lead agent in charge of this shift. The warehouse is enormous, long and

wide enough for a pro football game.

Saccomanno pulls his small truck alongside an 18-wheeler holding two gray fiberglass bins, each 110 inches by 82 inches by 80 inches and strong enough to hold 9,000 pounds, and begins unloading his parcels into the large containers. He hands the invoices to Hanley who hands them to another agent, Al Maerkle, who takes them into the back office. Saccomanno's truck is one of the first of about 18 small trucks to reach the area and for the next several hours the procedure will be repeated over and over again.

The Boston-bound package is one of those placed into the large containers. As the last trucks enter and finish off-loading, Tom Parcase begins tightening the stays on the 18-wheeler, making sure the large containers are secure. Webbing is pinned down. The last Econoline van enters the warehouse and is unloaded. Hanley nods to Parcase, who finishes buttoning up the containers.

8:30 p.m.—The 18-wheeler eases as delicately as possible out of the warehouse driveway. The streets are rough and the shock absorbers weak, but how much comfort does a package really need? "The ride to the airport will get you ready for the ride on the airplane," laughs Parcase.

At the Airport

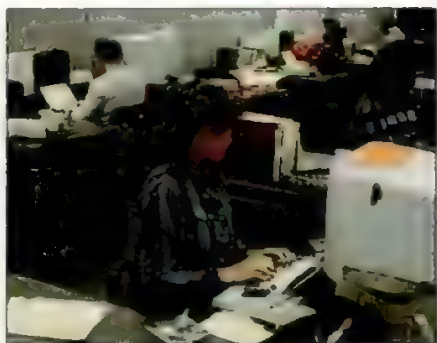
9:15 p.m.—Parcase backs his truck into the Kennedy Airport depot. Several people pull the gray containers from the truck onto coasters so they will slide easily. At night, this more than one-half acre floor is the outbound distribution area. By day, it reverses roles and handles all of the inbound packages.

Mike Krill, the outbound supervisor, watches his crew move the Long Island City containers along the conveyor belt made of coasters. He is waiting for additional trucks from Newark, New Jersey; Rye and Albany, New York, as well as smaller pickups from Long Island and Manhattan. All cargo has to be packed here into eight containers for the flight to Wilmington, Ohio, Airborne's central



Photos from top to bottom: Clerk at the Lexington Insurance Company preparing an airbill on the PC; truckdriver coding packages by hand in the mailroom of the Lexington Insurance Company; loading the truck prior to the drive to the Queens warehouse; entering billing rates and checking the invoices at the Queens warehouse.

Photographs: John Tension



Photos from top to bottom: Using a PC to punch the coded bills into the main computer located in Seattle; packing one of eight fiberglass containers for the flight to Wilmington; Airborne's DC-9 waiting on the runway prior to being loaded with the fiberglass shipping containers.

hub. Krill and lead agent Gary Nerko will have to pack those containers. The job sounds easy, but it can be as intricate as a jigsaw puzzle.

10:05 p.m.—Eddie Tillman, 38, sits at an IBM PC terminal inside the office next to the loading area and begins punching the coded bills into the main computer, located in Seattle. There are eight clerks and five agents working in an office that is set up like a large horseshoe. The clerks and agents complete the coding that Maerkle began in Long Island City as well as all of the other billings.

After Tillman enters the information from the AIG slip, an operator at the company can punch into the computer system and learn that the package is enroute to the Ohio sorting center.

10:10 p.m.—The truck from Newark arrives. Packages are quickly unloaded and packed into the eight gray fiberglass containers. "The people here know that the first container has to be heavy, so they pack it like a bomber," says Krill. In the center of the first container, which weighs more than 5,000 pounds sits the Boston-bound package. As the final trucks drop their loads, workers push the first two containers back onto a truck to be taken to the DC-9 waiting on the airstrip.

Up, Up, and Away

11:05 p.m.—The 18-wheeler, now heavier with the two containers fully-loaded, is driven through the back entrance of the airport. Each container is first pushed onto a portable elevator that rises to the cargo port and then pushed into the plane.

11:57 p.m.—The plane taxis through the clear night 3 minutes before the scheduled departure. The cockpit ceiling and forward panel are softly lit by the glowing indicators and gauges. Captain Robert Geyer and his first officer, Don Woodson, go through their pre-flight checklist. Everything stops dead, and the pilots cock their heads to listen and check their instruments. When the tower signals that they are cleared for take off, Geyer and Wood-

son begin moving the plane down the runway. Once off the ground, the plane begins its slow, steady ascent to more than 30,000 feet. It is 488 miles to Wilmington, Ohio. The flight and landing are uneventful.

1:20 a.m.—"Welcome to Wilmington, Ohio," says John Calabro, director of

The procedure in Boston is like a film run backward compared to New York 10 hours earlier.

ground handling. As he escorts the passengers from the plane, a string of motorized carts swings across the field to begin the off-loading operation.

At The Hub

1:30 a.m.—The inside of the 2½-year-old central sorting building looks like something built a child playing with a giant Erector set. It's 85,000 square feet are divided into slides, chutes, and ladders. More than 2½ miles of conveyor belts wind around, through, and above walkways, shelves, and staircases made mostly of metal grids.

At more than a dozen spots throughout the building, employees, mainly college students or wives working a second job to help make ends meet, mill about in groups of 10 to 20. As the train of carts from the New York plane pulls into the first station, the groups dissolve. Each member, clad in an Airborne uniform, takes a position. The first parcels from the plane are loaded onto the conveyor belt.

Perhaps what is most surprising is how unautomated the whole process is. As the packages round the first turn, they head toward three manual sorts. First, they are segregated by area, (for instance, Northeast), then by a more limited region (say New England), and finally, by city. Esther

Scott of Hillsboro, Ohio, is one of 110 sorters who read the black coding put on each package by the driver. The Boston package moves down one conveyor line at 150 feet a minute. Scott reads Saccomanno's "BOS 4B" code and tosses the package onto the 4B line. The package finds its way through a jungle-gym of metal and rubber. Two more sorts and 20 minutes later, it ends up in a hamper bound for Boston.

4:35 a.m.—The last plane arrives and its contents are sorted and loaded on the Boston-bound DC-9. With the DC-9 poised at the runway, the voices of the cockpit crew drone hypnotically as the checklist is run through. Finally, with a steady whoosh, the plane arcs up at an alarming angle and soars into the sky heading 300 miles east to Baltimore.

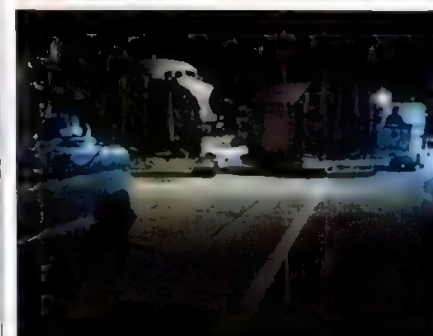
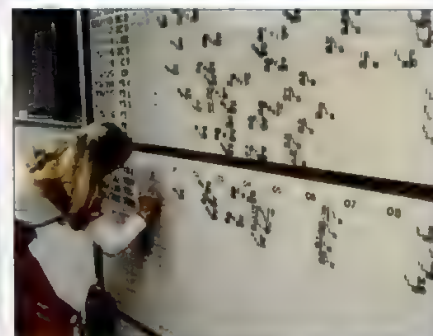
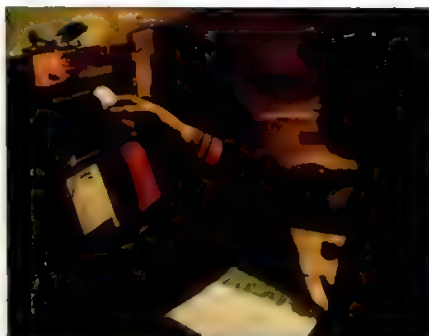
Morning in Baltimore

5:47 a.m.—The plane taxis to the terminal. On a typical day, the turnaround time can be as short as 20 minutes. But today there is a howling rainstorm that slows refueling and unloading. The plane drops off the packages that will be delivered here and loads up eight double hampers and 16 single hampers for Boston.

6:39 a.m.—The plane takes off again, about 10,000 pounds lighter than when it arrived. This is the last air leg to Logan Airport in Boston. The sky grows lighter as the flight continues. They're still running late.

7:55 a.m.—Within 11 minutes of the plane's arrival, workers are scurrying to load the waiting trucks. Within another 7 minutes, Tom Campagna starts his truck engine and tears out of the airport for the 3-mile run to the terminal. "I've got to drive fast," he says. "Usually I'm a cowboy. You've got to be a cowboy in this job."

8:10 a.m.—The procedure in Boston is like a film run backward compared to New York 10 hours earlier. Then, everyone rushed to pack; now the haste is to break down and sort. Packages for Boston are fine-sorted according to truck routes.



Photos, left column, from top to bottom: Checking the weight and distribution of the freight on board; readying the fiberglass containers at the hub in Wilmington; Airborne's central sorting area. **Right column, from top to bottom:** reading the coding during the three-part manual sort; the tracking board at the Wilmington facility; back out to the plane bound this time for Boston; unloading cargo at Logan International.

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JOURNEY



Photos from top to bottom: Trucks loaded with the Wilmington cargo heading for the terminal; fine-sorting packages at the Boston Terminal according to truck routes; Airborne van and deliveryman making a delivery in downtown Boston; end of the journey for the Boston-bound package.

Packages bound for as far away as Portland, Maine, are moved to their vehicles.

Each driver has a computer-generated manifest sheet with today's deliveries, says the manager, Mike Gleason. Each driver will check each package against the list compiled by the main computer from all of the entries during the night. Missing and extra packages are carefully noted and will be queried through the main computer. Customers with PCs can now check to see if their packages have arrived at the distribution points.

Mission Accomplished

Today Russ Kinnear will handle about 75 pieces, he notes as he checks through his manifest. He looks at his watch, which reads 9:01 as he drives out of the warehouse. He estimates that more than 76 percent of his packages will be delivered by the 10:30 a.m. deadline, down from the 85 percent rate that corporate officials say is the system's usual delivery. "I'm 20 minutes late," he says, "but the plane was 45 minutes late today."

9:18 a.m.— The office building is black. Kinnear grabs packages for the five offices he will visit here today and heads through the lobby. The morning newspapers are on sale. People are arguing about yesterday's election, a mayoral primary won by just one vote.

9:22 a.m.— Kinnear walks through the hallway to make his first delivery to Lexington Insurance. It is the package that began in New York. In just under 20 hours, the package has traveled some 35 miles in four different trucks and in half a dozen different types of carts, containers and hampers. It has flown almost 1,000 air miles and has been lifted, sorted, and packed by two dozen hands in three different states.

Mary Karaberis, the receptionist, isn't impressed by the package's sojourn. She signs the receipt. Kinnear smiles and rushes to his next stop.

As far as everyone is concerned, it is just another routine day. ■

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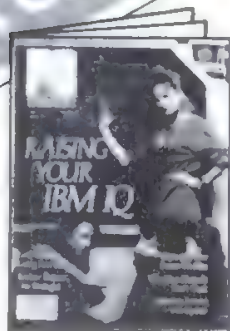
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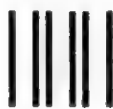
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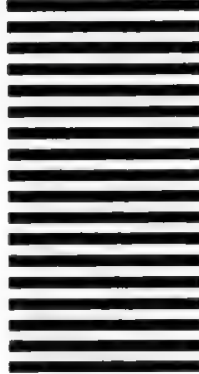
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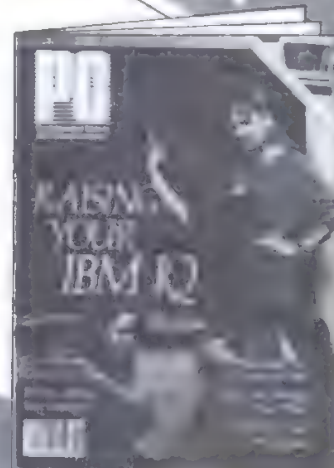
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Transmitting Messages With MCI

An established communications company joins with the traditional mail courier, Purolator, to offer personal computer owners four innovative methods of transmitting messages.

While the United States Post Office is meeting the challenges of the computer age by adding digits to the zip code, other American companies have been thinking up ways to utilize the new technology. One such company, MCI Communications

MCI Mail

MCI Communications Corporation
1133 19th St. NW
Washington, DC 20036
(800) MCI-MAIL

List Price: Fees vary depending on service; there is no charge for registration.

Requires: 110 to 1200 baud modem, terminal communications software.

CIRCLE 684 ON READER SERVICE CARD

Corporation, has recently joined forces with a company known for its more traditional means of message delivery, Purolator Courier. Together, the two are creating a new market for computer-transmitted mail.

The result of the collaboration is MCI Mail, which began offering a variety of letter services to PC and other microcomputer owners on September 27, 1983. MCI Mail allows computer mavens to send letters to other micro owners, regardless of differences in hardware, via a home computer equipped with a modem and communications software. The service also allows you to send hard copy messages to the unfortunates who have not yet joined the micro ranks.

When you sign up for MCI Mail, the

service asks you for some basic information (name, address, type of equipment) which it stores in its main computer. It randomly assigns you a five-letter password, usually with a vowel/consonant/vowel/consonant sequence.

Getting Started

MCI Mail offers four separate services: Instant Letter, Four-Hour Letter, Overnight Letter, and MCI Letter. Registration for any of the MCI Mail services is free, but each service charges different fees.

To log on, you dial MCI's local or toll-free number. When you've made the connection, you type in your user name (your first initial and last name). MCI will then ask for your password. If you enter it incorrectly three times, the program will

throw you off the system. However, if you enter your code correctly, the phrase "Welcome to MCI Mail" will flash across your screen. The program will give you some sort of updating information—a little anecdote or some MCI news. The message changes every day.

Before you select which of the four types of letters you wish to send, MCI will inform you if it has any messages for you.

If you want to send a letter quickly to someone who does not own a microcomputer, Purolator steps in to help.

If, for example, you have three, and one is marked "priority," you have a choice of scanning all three or going directly to the priority message. If the priority demands an immediate reply, select "answer" from the menu. MCI already has the person's name and address, so you don't have to type in that information.

Once you've answered your mail, you might select the Instant Letter option to send an electronic letter to another MCI subscriber. The charge for this service is \$1 for each increment of 7,500 characters (three to five 8½-by-11 pages).

The program will ask you for the name of the person you wish to contact. Say you're writing a letter to John Smith, and MCI has 25 members with that name. It will then list every John Smith who has registered, which is similar to what happens when you call 411 for telephone information. Chances are you will know which one you are writing to and will identify him by entering the number given. The program will then list the name and the correct address.

If the John Smith you are looking for isn't listed, you can enter the address, and

the program will tell you that you can't contact him with an MCI Letter because he isn't a subscriber. You'll have to choose one of the three other MCI services to reach him.

Once you've located the name you are looking for, type in your letter. When you have completed it, MCI asks you if you want to edit the letter and/or the envelope (which means, do you want to correct errors in the text or address). It also gives you the option to send carbon copies (duplicate messages) and asks you via which MCI service you wish to send them. And that's it!

"It's very simple. That's what's so incredible about it," commented Bill Stern, marketing manager of MCI Communications.

Instant Letter, of course, does not

require the services of a courier company. However, if you want to send a letter quickly to someone who does not own a microcomputer, Purolator steps in to help with the MCI Mail Four-Hour Letter. Unlike the Instant Letter service, where your message is bounced from MCI's central computer in Illinois to the receiver's home computer, in this case the message is transmitted to an MCI location in one of 15 cities: Atlanta, Boston, Chicago, Cleveland, Detroit, Dallas, Houston, Los Angeles, New York, Minneapolis/St. Paul, Pittsburgh, Philadelphia, San Francisco, St. Louis, and Washington, DC. At this point, a laser printer generates a black-and-white hard copy, which is sealed into a specially designed envelope and within 4 hours is delivered by Purolator within the city area. The Four-Hour Letter costs \$25

MCI at Stevens Institute of Technology

The first institution to require students to own computers uses MCI Mail to transmit messages.

Richard Widdicombe is the library director at Stevens Institute of Technology, a Hoboken, New Jersey, engineering school and the first institution to require all students to have personal computers. "When I heard about MCI Mail," explained Widdicombe, "I realized that it was another service Stevens should get involved in. The library is fully computerized anyway; we use all kinds of databases, and electronic mail would provide us with certain mechanisms for contacting a lot of our clients."

Stevens uses a variety of computer systems, including those from Apple, Hewlett-Packard, and DEC. While MCI's Instant Letter service is used to send messages among staff members, Widdicombe finds that for campus-related business the Overnight Letter, which makes electronic mail accessible to those who do not use computers, is the most

desirable part of the package.

"The other day," he related, "I got a letter from an alumnus. We have a carillon on the campus that plays tunes, and he wanted something special played for the alumni dinner. It took me a little while before I found a musician who would play it. Alumni day was coming up soon, and I couldn't get him on the telephone. So I sent him an Overnight Letter delivery. He got all the information he needed and was impressed, too."

Widdicombe has found a few bugs in the system since he began using it in October 1983. However, MCI has been responsive in either explaining or correcting the difficulty. Said Widdicombe, "There are a lot of little editing problems we have noticed. All you have to do is send an electronic notice to MCI and tell them about it, and they patch it up—usually the next day." —B.K.

for each 7,500-character increment. A similar same-day service by a traditional carrier from, say, New York City to Washington, DC runs about \$100. Currently, the 4-hour service is restricted to 15 cities, but MCI Mail hopes to increase this number soon.

The Overnight Letter

If you do not live in one of these cities, or if you are not in too great a hurry, you could send an MCI Overnight letter.

Say, for instance, you want to send something overnight from New York to Des Moines, Iowa. You access MCI and enter your message, which, in this case, would be transmitted to the MCI location in Cleveland, Ohio, where the overnight message would be sent via air to Des Moines, and would be delivered overnight. The MCI Overnight, which is available daily during normal business hours, costs \$6, approximately half the Federal Express charge for a similar service.

The fourth service is the MCI Letter. This original concept makes use of not only the MCI system and Purolator's couriers, but also the United States Post Office. "What we have put together here," commented Stern, "is a system that will bring business back to the United States Post Office. We are not competing with them; if anything, we will be giving it business that it has been losing to the time-sensitive deliverers."

In this case, a letter generated from a home computer is sent through the MCI Mail network and a hard copy is printed. Purolator delivers it to the addressee's post office, where it is mailed via United States mail. So, with any luck, the copy will be delivered the next day. The cost for this service is \$2.

No Missing Messages

MCI Communications stated that since it began offering MCI Mail, about 70,000 customers have signed up, and none so far have registered any complaints. Any lost messages? "No," reported Stern. "In the age of electronics, you're not going to

have a lost message floating around somewhere. And Purolator is the most respected of the air couriers in terms of loss. It's

One of the reasons that MCI Mail is expected to be successful is its combination of experience and resources.

one of the reasons we entered this venture with it."

In fact, both MCI and Purolator agree that one of the reasons that MCI Mail is expected to be successful is the combination of the experience and resources of both companies. "MCI already had a long distance communication network in place," said Stern. "If another company were to enter this business, it would take years to build a network."

Hollis McLoughlin, of Purolator commented, "Like any progressive company, we're trying to expand our product line." He believes a product such as the MCI Mail Overnight Letter is especially useful for home computer users who want to send a hard-copy document quickly but do not have easy access to courier companies. "If you work primarily out of your home, and you have a personal computer, you can use your computer as a courier service, without having to leave your home." Stern added, "If I wanted to send a letter and have it arrive the next day, I would type it on a typewriter, have my secretary call a courier service, which would have to come and pick up the package at my office. In the meantime, I would have to fill out all the paperwork and prepay for the service. Or I can sit at my computer using MCI Mail, and none of this is necessary."

An added benefit: Users of dedicated word processors can use MCI Mail to

transmit stored documents among the Lanier III, Wang, Xerox 860, IBM Display Writer, Decmate II, CPT, and NBI word processors without having to retype them. Using the "batch mode," users can log on, enter their code, and rapidly send or receive the information without any further interaction.

Problems and Solutions

One possible problem that may have occurred to potential MCI Mail customers is that of sending documents that require a signature or letterhead stationery. MCI has this one solved. For a one-time fee of \$20, it will register your letterhead and signature to be used with the letter anytime you specify. Stern noted that he has four signatures on register with the service: one for legal documents, one for business documents, one for casual acquaintances on a first-name basis, and one for close friends who know him by a nickname.

MCI has also provided an additional security measure to prevent outsiders from using your password. The service informs you of this failsafe when you sign up. Although the method could be broken, MCI believes the odds are definitely in its favor.

Of course, there are problems that have not yet been solved. The Four-Hour Letter service is limited to the 15 presently serviced cities.

And, currently, you can send only messages that use the letters, numerals, and symbols on your computer's keyboard. Graphics capabilities are beyond the limits of the MCI Mail network, but the company is planning to add this feature in the near future.

These limitations, however, are only minor annoyances. MCI Mail is an inexpensive, efficient means of transmitting messages that offers more than most electronic mail services. ■

Barbara Krasnoff is a free-lance writer and author of Robots: Real to Real, a novice's guidebook to robotics, published by Arco Publishing, Inc.

DATABASE FACILITY

GDSS is suited to interface to any existing or user-developed databases for effective aggregation, organization and manipulation of data. The system has a large local storage capability and can accept files from either a host computer or other source. Once loaded into GDSS's own internal database, subschema or views developed by multiple users from a common file can be interrogated interactively through the use of a powerful query language, which allows the user to select or sort particular items as well as perform mathematical computations on the results.

MENU STRUCTURE

GDSS offers easy-to-use menu-driven software, enabling the user to design

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EASY TO USE CHART BUILDING TOOLS **Digitizer Tablet**

GDSS offers unlimited format styles, including bubbles, scattergrams, 3-dimensional bars, and multiplex formats. Layouts, overlays of equal or different sized graphs, rotations, split screen and multiple graphs on the same screen are also possible. In addition, new formats can be customized

through the use of the graphic editor and optional digitizer tablet. This enables the user to edit and modify the graph as well as design elements of any shape or size.

ARITHMETIC OPERATIONS

GDSS provides immediate support in the process of analyzing large amounts of data to extract trends, and, in general, support the complex decision making processes. Numerous arithmetic, statistical and logical operations are available for these analyses.

DEVICE INDEPENDENCE

GDSS is totally input/output device independent — the system can accept input from many sources and produce output on a variety of graphics hardcopy devices

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CIRCLE NO. 251 ON READER SERVICE CARD

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The Landlord is a software package

The Landlord

Systems Plus, Inc.
1120 San Antonio Rd.
Palo Alto, CA 94303
(415) 969-7047

List Price: \$595

Requires: 128K, RAM, two disk drives, printer, BASRUN.EXE (from the IBM BASIC compiler)

CIRCLE 729 ON READER SERVICE CARD

written by MIN Microcomputer Software and distributed by Systems Plus, Inc. It provides the property manager with an automated system for keeping track of tenant receipts, maintenance expenses, and other matters normally associated with rental property management. It can be applied to all types of rental property, including marinas, warehouses, shopping centers—even airplane hangars.

The Landlord's programs divide into two major subsystems: *The Property Manager*, which monitors tenant and rental unit information, and *The Financial Manager*, which tracks income and expense data and includes a computerized check-printing program. The configuration consists of a double-sided disk drive in drive A, a primary and backup disk for each of the two subsystems, and a sample data disk. The promotional material indicates that the data disk can handle up to 500 tenant units. If this isn't enough, additional data disks can be formatted with a

CREATE utility included in the package. For single-sided drives, an alternate version is available in which each subsystem is split into two diskettes. The installation procedure also describes the method for installing *The Landlord* on a fixed-disk system.

The programs, formatted in compiled BASIC, require the BASRUN.EXE module, the run-time library for the BASIC compiler. Thus, to run *The Landlord* programs, you must also have a copy of the IBM BASIC compiler.

The Property Manager

The Property Manager subsystem has three main menus: File Management, Payments and Charges, and Reports. File Management stores information on five data entry screens: owner name and address, property name and address, type of unit, rental unit details, and tenant data.

The data entry screens are very easy to

LANDLORD

use and are consistent throughout; for instance, when editing is required the same prompts, "add" and "modify," appear on all the screens. Substantial care has been taken to prevent data entry errors. For example, the keyboard input routine will only recognize numeric characters for numeric fields. In addition, many fields have default values already filled in. You can either use the default value by pressing the Enter key, or override it by entering your own value. The default value for tenant status, for instance, is "present and occupying." You may change this to "past" or "future," or you may leave the designation unchanged.

Data entry procedures would be improved by the addition of an escape code. On occasions that I had forgotten a code value, I had no convenient means to escape from the screen and produce the listing of appropriate codes. The default headings for entering data in each File Management category are not entirely adequate, particularly for information pertaining to rental unit and lease details. The available fields for data entry are probably adequate for residential property, but not for commercial property. For a commercial lease, you would normally wish to record more information than just the lease's expiration date! This problem is partially offset by the comments fields in the rental-unit and tenant-data screens. The fields offer 25 and 50 character spaces, respectively, for storing additional information.

Once you have loaded your property and tenant information, you will spend the bulk of your time in the Payments and Charges menu. This subprogram enables you to bill tenants and record receipts against each charge (see Figure 1).

At the beginning of each month you normally run the monthly rent-posting routine, which creates a rent charge for each tenant who currently occupies a unit. (Data may also be kept on future and past tenants.) The routine may be run only once per month; internal controls prevent you from running it more often.

*** TENANT PAYMENTS/CHARGES ***			
TENANT#	2	Glenn Jones	
DATE	TRANS CODE	ACCOUNT	AMOUNT
01/05	RC	RENT	+ 475 00
01/05	RP	RENT	- 475 00
01/05	ZP	PARKING (INDOOR GARAGE)	- 35 00
01/15	FC	CLUBHOUSE RENTAL	+ 30 00
01/16	IC	BOAT STORAGE	+ 38 50
PREVIOUS BALANCE	-45 00		
CHARGES	543 50		
PAYMENTS	-510 00		
PRESENT BALANCE	-11 50		
SEC DEP	300 00	OTHER DEP	0 00
*** Any changes? N(***			

Figure 1: A typical screen from the Payments and Charges section of The Property Manager.

In addition to the monthly rent charge, the Payments and Charges screen can handle up to seven additional payments and charges per month (that is, those that occur between automatic rent postings). A two-letter code distinguishes between payments, charges, and returned checks, and identifies the income account to which a payment will be applied in *The Financial Manager*. Special transaction codes are used for security deposits and other tenant deposits.

A variety of reports are available from the Reports menu of *The Property Management* subsystem, including lists of tenants and units, a vacancy report, a lease expiration report, a delinquency report (that is, tenants with unpaid balances) and a full tenant payment register (see Figure 2). All reports are sent to the printer, there being no provision for producing reports on the terminal. The system has the ability to produce monthly tenant statements (but not annual statements) and a handy feature that produces tenant mailing labels.

The Financial Manager

The Financial Manager's primary purpose is to generate income and expense statements, either by property or by owner. *The Financial Manager* provides a chart of accounts consisting of 26 tenant

income accounts, 5 other income accounts, 45 expense accounts, and 7 specialized accounts for things like note payments and depreciation.

The 26 tenant income accounts are identified by a letter code. Most of these can be renamed to suit your individual needs, but some such as rent (R) and security deposit forfeiture (S) are fixed. The expense accounts (numbered 101-145) and other-income accounts (146-150) may be renamed; the seven specialized accounts may not.

Account balances are updated in three ways: by the tenant receipts from *The Property Manager* subsystem and by checks or journal entries in *The Financial Manager* subsystem.

The letter code used in the tenant payment routine (in *The Property Manager* program) will automatically cause a payment or returned check to update the corresponding tenant income account. The system employs cash basis accounting and does not post tenant charges to the income accounts—only tenant payments.

The Financial Manager subsystem contains a check-recording program, and each check may be distributed to up to 6 of the 45 available expense accounts. In support of the check-writing activity, the system maintains a vendor name and address

LANDLORD

*** PRINT REPORTS ***

1. OWNER LISTING
2. UNIT TYPE LISTING
3. PROPERTY LISTING
4. RENTAL UNIT LISTING
5. TENANT LISTING
6. LEASE EXPIRATION REPORT
7. VACANCY REPORT
8. TENANT PAYMENT REPORT
9. DELINQUENCY REPORT
10. STATEMENTS
11. MAILING LABELS
12. RETURN TO PROP MGR MENU

Figure 2: Reports available from the Reports section of The Property Manager.

file, and checks may be made payable to either a tenant or a vendor. Of course this means that you have to set up a vendor record for each person to whom you wish to write a check.

You may instruct the system to physically print the check or to suppress check printing. *The Landlord* package includes a sample check, a sample tenant statement form, and an order form for continuous-feed checks and statements (and matching window envelopes).

The journal entry program, used to record noncash transactions, may update any of the income, expense, or other accounts. The journal entries include a plus or minus indicator rather than a debit/credit notation. A plus amount increases the balance of an account, regardless of whether it is income or expense. Some users may prefer this nonaccounting notation; I found it awkward.

The Landlord's chart of accounts does not include any balance sheet information. There is no account for keeping track of the balance in your checking account, and

although the check distributions are posted to expense accounts, the check itself is not posted anywhere.

Similarly, there are no accounts for owner's equity position or for depreciable balances on capitalized improvements. There are accounts, however, for depreciation expense and for debt payments of principal and interest.

The major report of *The Financial Manager* (see Figure 3) is the Property and Tax Analysis, an income/expense statement that calculates cash flow, net taxable income, and an after-tax net equity income. The pre-defined format permits no user tailoring.

The account labeled "Appreciation" is unusual. Its balance is added to after-tax income to arrive at net equity income. Property appreciation is usually a tough

(continued)

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```

Enter a selection: (
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4. PRINT CHECKS
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8. RETURN TO FIN MANAGER MENU

Enter a selection: (
  
```

Figure 3: Reports available from the Reports section of The Financial Manager.

rent. Items such as common area maintenance and association fees have to be charged individually each period.

In spite of these shortcomings, I think that MIN and Systems Plus have done a nice job with *The Landlord*. The system itself is very easy to use, and the documentation is both thorough and understandable.

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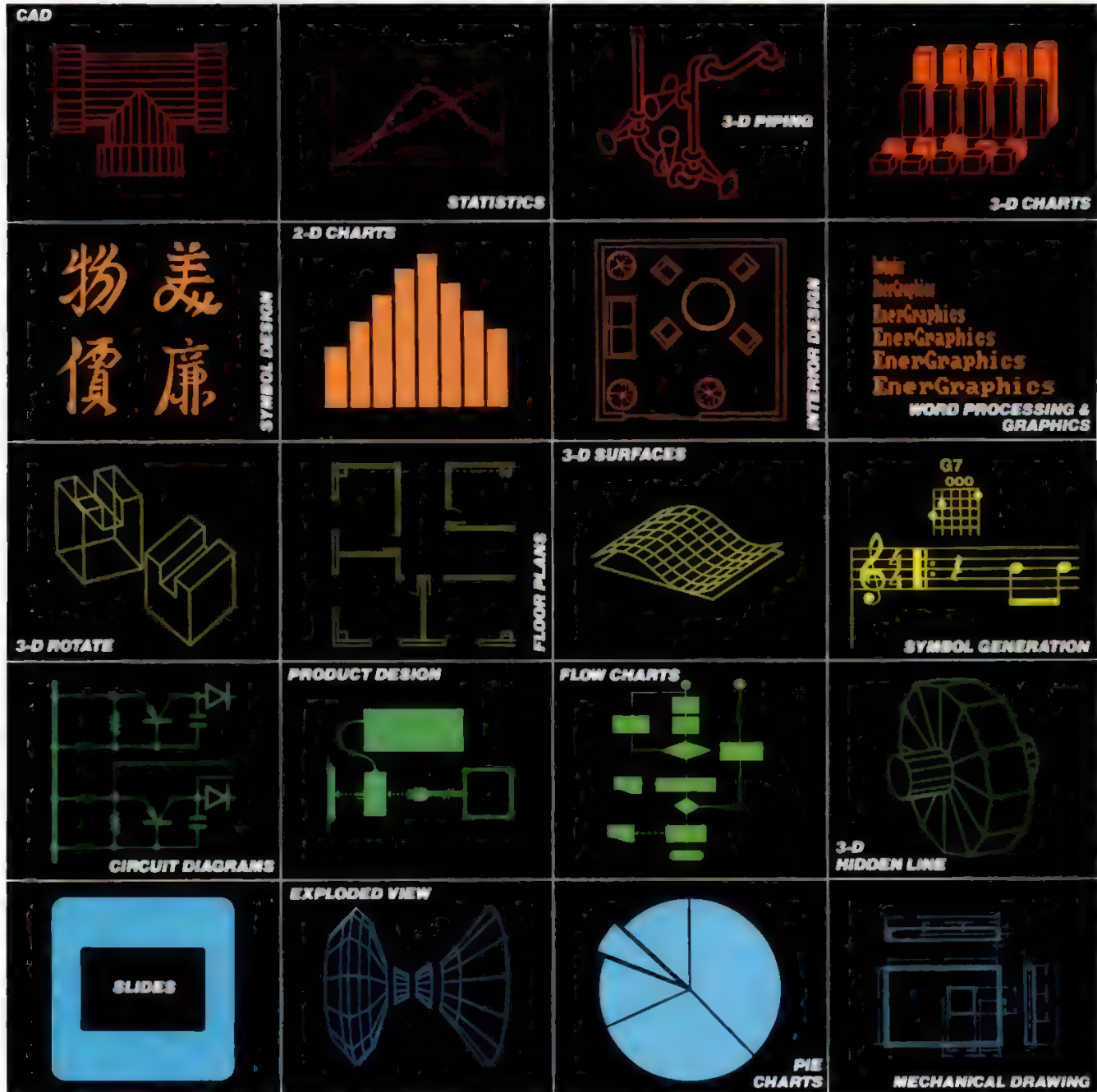
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Assembly Language: More Basic Than BASIC

Assembly language for the IBM PC is the most fundamental means of communicating with the PC's microprocessor short of binary code. It's also fast and powerful.

With this issue, *PC Magazine* begins a series of book excerpts designed to introduce our readers to assembly language for the IBM PC. Portions of this and future articles—reproduced with permission from the copyright owners—will be included in the book *Assembly Language Primer for the IBM PC* by Robert Lafore, to be published by The New American Library under the Plume/Waite imprint, copyright 1984 Waite Group, Inc., San Rafael, California. All rights reserved. The introduction and first chapter have been condensed in a sidebar (see “Getting Started With Assembly Language”), and our installment begins with Chapter 2, which will lead you step by step through writing an elementary assembly language program using the DEBUG utility.

We're going to start by describing the writing of a complete, though very short, assembly language program. Then we'll go back and talk in more detail about the steps used in the process and what they mean. We'll finish up with some variations on our program.

YOUR FIRST PROGRAM

Although you're now going to write your first program in assembly language,

you don't know assembly language yet. There will thus be many aspects of the process that won't seem completely clear to you. Don't worry about this!

By moving from the concrete to the abstract, we hope to avoid the sort of academic theory-oriented descriptions that leave most readers confused, bored, and frustrated. Instead, you'll first get the *feeling* of the process (the roar of the motor and the rush of the wind in your hair).

Later we'll explain what happened.

Two Versions of DOS

There's a small problem we better deal with right away. This has to do with which version of DOS you're using. The DEBUG in DOS version 2 (that is, versions 2.0 and later) has a built-in mini-assembler that will help in the creation of assembly language programs. The DEBUG in DOS version 1 (versions 1.0 and 1.1) does not have this capability.

We'll handle this situation in the following way. We'll first explain how to type in a program if you're using DOS version 1. Even if you have version 2, you should read this part, try it out, and understand it.

Writing with the E Command

In this section, we'll create an assembly language program using DEBUG's E

command. If you have DOS version 1, this is the *only* way to use DEBUG to create a program. If you have version 2, you should, as we suggested above, follow along anyway, typing in the commands we show.

The purpose of the E command is to enter a byte (or bytes) of data into memory. It's a little like the F command except that you can enter a series of *different* bytes; they don't all have to have the same value, as they do with F.

The series of bytes we're going to enter with E will constitute our program. To insert this program into memory, you enter the command E, followed by the address where you want the program to go. In our case, we're going to put it at location 100h, so we enter E followed by 100. The program will respond by printing out the address, followed by its current contents (see Figure 1).

As shown here, the contents of location 100 happens to already be 61h, put there with the F command earlier. However, it doesn't really matter what was there before: The important thing is what we're going to put there now.

To enter a two-digit hex number into this location we type the number followed by—*not* the Enter key—but the *space bar*. The space bar has the effect of entering *one number* and going on to the next one. The Enter key, on the other hand, enters the number and then terminates the entire E command and returns us to the DEBUG prompt. After you have entered a number and pressed the space bar, the command will then print the old contents of the *next* location, and wait for you to type in the new contents.

The series of hexadecimal numbers we want to type in is the following:

```
B2
1
B4
2
CD
21
CD
20
```



Assembly Language Primer for the IBM PC

Robert Lafore

(The New American Library, Inc., New York, forthcoming) softcover; Price to be announced

CIRCLE 713 ON READER SERVICE CARD

These are the numbers that constitute our program. Type each number, press the space bar, type the next number, and so on. After you've typed in all 8 numbers, the screen should look like Figure 2.

(If you don't type any number at all before hitting the space bar, the byte in that location will remain unchanged.)

After we type the last number, we press Enter to tell DEBUG that we're through. This should cause the reappearance of the DEBUG prompt (-).

If you make a mistake, just press Enter to get back to the DEBUG prompt and start over.

You've now placed your program in the computer's memory, from location 100 to 107, using the E command. We'll explain how to execute or "run" the program in a moment.

Writing with the A Command

Here's where you DOS version 1 users become, briefly, mere spectators. You should read through this section so you

know what you're missing. You'll need to know both approaches so you can use E even though we're talking about A; that is, translate our descriptions to the A approach into operations with E. This won't be as hard as it probably sounds, so stop complaining and keep reading. Or, better yet, hurry out and buy a copy of DOS version 2.

The A command accomplishes the same thing as the E command—that is, putting the bytes that constitute our program into memory—but it does it in a different way.

When we use the A command we don't insert hexadecimal bytes into memory directly. Instead, we type in a series of mnemonic symbols. ("Mnemonic" simply means "easy to remember." The idea is that these symbols are supposed to be easier to remember than the hexadecimal numbers they represent.) These codes are two- or three-character names that stand for certain assembly language *instructions*. The instruction tells the microprocessor *what operation is to be done*. The instruction mnemonic is usually followed by a space and then by some letters and numbers that indicate what the operation is to be done *to*.

Expressed in mnemonic symbols, our program looks like this:

```
MOV DL, 1
MOV AH, 2
INT 21
INT 20
```

We're going to type in this program, then dissect it a little and see if we can get a feel for how the A approach relates to the E approach and for what assembly language is all about.

Enter the letter A, followed by the address where you want the program to go. Here's a rule you should remember: *Programs written in DEBUG should always start at 100h.*

When you enter A followed by an address, DEBUG will automatically echo the address (see Figure 3).

DEBUG will then sit there waiting for

ASSEMBLY LANGUAGE

you to type in the mnemonic codes for your program.

On the first line, enter MOV DL,1. That's MOV as in the first three letters of move, followed by a space (which is important), then DL,1. Don't confuse letters and numbers: it's dl with the *letter* L, followed by a comma and the *number* 1. The screen should now look like this:

```
08F1:0100 MOV DL,1
08F1:0102
```

You've just typed your first line of assembly language!

The assembler is waiting for line 2. Enter MOV AH,2. Then the third line, INT 21, and the fourth, INT 20.

After you've finished these four lines, you're done. So when the program tells you this

```
08F1:0108
```

you simply press Enter to let it know you're through assembling this program and want to get back to DEBUG's prompt.

Your screen should now look like the one shown in Figure 4.

So, you now have two different ways to enter your program, depending on which version of DOS you have. In either case

the program itself should now be sitting in memory and waiting to be executed. There's a lot to say about the relationship between these two approaches to putting the program into memory, but if you're a real red-blooded programmer, you can't wait to run the program.

RUNNING THE PROGRAM

What does this program do? Does it balance your checkbook? Calculate accounts receivable? We're afraid it's not quite so ambitious as that. Let's see what happens when we run it (see Figure 5). To execute the program we use the G (for GO) command. Simply enter the letter G. It's not followed by any numbers (this time). This executes the program, just as entering RUN does in BASIC.

What happened? The program printed a happy face on the screen! Isn't that the cutest thing you ever saw? (No? Well, what did you expect in an 8-byte program?)

If you didn't get a happy face, you probably made a mistake typing in the program. It's easy to mistype something, what with all the numbers and unfamiliar symbols. Start over with the E or the A command, and try again.

Unfortunately, mistakes in assembly

language programs can have more serious consequences than those in higher-level languages such as BASIC. In higher-level languages the interpreter or compiler usually protects the operating system from the consequences of errors in programming, so that your machine keeps running and says something like "error in line 2034."

In assembly language, however, there is no such protection. Assembly language is the most fundamental level of the machine; there is nothing on a "supervisory level" overseeing the assembly language program, as the interpreter or compiler does in higher-level languages. So if you make a mistake in assembly language, it is woefully easy to "crash" your operating system.

Let's look in memory with the D command and see if we can find our little program (see Figure 6).

There it is, in the first 8 locations, from 100 to 107, as you can see by comparing these numbers with those typed in using E. Our program has overlayed the 61s that were there before.

The symbols on the right, 2.4.M!M, are meaningless. They just happen to be the ASCII equivalents of the numbers that make up the program.

```
-e100      <---you enter this
04B5:0100  61.
|
|          the cursor will wait here
|          for you to type in a two-digit number
|
|          offset address is the same
|          as what you typed in
segment
address
doesn't
matter
```

Figure 1: The E command for location 100h.

```
-e100
04B5:0100  61. b2  61. 1  61. b4  61. 2  61. cd  61. 21  61. cd  61. 20
|          |          |          |          |          |          |
- <---DEBUG prompt      press space-bar following these numbers      press ENTER
                                following last number
```

Figure 2: Eight hexadecimal numbers entered with the space bar using the E command.

ASSEMBLY LANGUAGE

WHAT AN ASSEMBLER REALLY DOES

If you typed in the program using E, you probably aren't too surprised to see these numbers reappear when you look in memory with D. After all, you entered the numbers into memory, and there they are, just where you put them.

But how did they get there if you used the A command? You typed in mnemonic instructions, and lo and behold, there are hex numbers sitting in memory! What's happened here is this: the A command *assembled* the mnemonic instructions into hex numbers. This is the function of an assembler; both of DEBUG's miniassemblers invoked with the A command and of its large-scale relatives, the ASM and MASM assemblers. We'll have more to say about this in a moment. First let's look at our program from another perspective.

The U Command

There's a more elegant and useful way to look at our program than by using D as we did above: the U command. We've assembled our program with A or typed in the preassembled hex numbers with E. Now let's use the U command to *unassemble* it. The U command is the opposite of the A command. Where A takes us from symbolic mnemonic codes to the hex digits of machine language, U takes us from hex digits back to mnemonic codes. (Actually, the usual word for unassemble is *disassemble*.)

To "unassemble" your program, enter U, followed by the address where you want to start disassembling, then a comma, and then the address where you want to *stop* disassembling. (For an illustration, see Figure 7.)

There's the program in *both* hex codes and mnemonic instructions, all nicely arranged for you to admire! Thus the hex number B201 is the machine language equivalent of the assembly language statement MOV DL,01, and so on for the other instructions. As before, the numbers on the left, such as 08F1:0100, are the addresses of the locations occupied by the

```
-a100
08F1:100
      /!\
      |_____The cursor will wait here, blinking
```

Figure 3: DEBUG automatically echoes the address when you enter A followed by an address.

```
-a100
08F1:0100 mov dl,1
08F1:0102 mov ah,2
08F1:0104 int 21
08F1:0106 int 20
08F1:0108
- <-----simply press ENTER here
- <-----now you're back in DEBUG
```

Figure 4: Returning to DEBUG after entering four lines of assembly language code.

```
-g <---enter this
☺
Program terminated normally
-
```

Figure 5: Running the program with the G command.

program. There's an address printed for each instruction, and since each of the instructions happens to occupy just two bytes, the addresses are all evenly numbered: 100, 102, 104, and 106.

Machine and Assembly Language

The hex numbers on the left in the U listing in Figure 7 are what is called *machine language*. These numbers occupy specific memory locations, and the 8088 microprocessor looks in these locations, takes the numbers out of them, figures out what they mean, and executes them. These numbers are called "machine language" because it's the *machine*—the microprocessor—that understands them and operates on them. As far as we humans go, such numbers are hard to understand and hard to remember.

Take heart, however. The mnemonic instructions in the column on the right in the listing in Figure 8 form what is properly called "assembly language," and while you may not understand these instructions now, you soon will.

It is the function of an *assembler* to translate assembly language, which is comprehensible to humans, into machine language, which is comprehensible to microprocessors.

ASSEMBLY LANGUAGE INSTRUCTIONS

You've typed in the program, and run it, and disassembled it again, but of course you still don't really understand how it does what it does. To understand the program we must understand the individual instructions in it and what they do. In this section, we'll look at the instructions one by one. But first we need to understand another fundamental concept: *registers*.

Registers

A register is a place in the microprocessor where our program can put a byte, or sometimes 2 bytes, of data. A register is something like a memory location, except that it has various special properties that a memory location doesn't. One of these properties is that the microprocessor can

ASSEMBLY LANGUAGE

	program																
-d100																	
0BF1:0100	B2	01	B4	02	CD	21	CD	20-61	61	61	61	61	61	61	61	61	2. 4. M!M aaaaaaaaa
0BF1:0110	61	61	61	61	61	61	61	61-00	00	00	00	00	00	00	00	00	aaaaaaaaa.....
0BF1:0120	FF	FF	FF	FF	FF	FF	FF	FF-FF	FF	FF	FF	FF	FF	FF	FF	FF
0BF1:0130	FF	FF	FF	FF	FF	FF	FF	FF-FF	FF	FF	FF	FF	FF	FF	FF	FF
0BF1:0140	FF	FF	FF	FF	FF	FF	FF	FF-FF	FF	FF	FF	FF	FF	FF	FF	FF
0BF1:0150	00	00	00	00	00	00	00	00-00	00	00	00	00	00	00	00	00
0BF1:0160	00	00	00	00	00	00	00	00-00	00	00	00	00	00	00	00	00
0BF1:0170	00	00	00	00	00	00	00	00-24	24	24	24	24	24	24	24	24 \$\$\$\$\$\$\$\$

Figure 6: Searching memory with the D command.

-u100,106 <---you enter this									
0BF1:0100	B201	MOV	DL,01	\					
0BF1:0102	B402	MOV	AH,02	!	the program prints				
0BF1:0104	CD21	INT	21	!	out all this!				
0BF1:0106	CD20	INT	20	/					
- -									

Figure 7: Disassembling the program with the U command.

do a simple kind of arithmetic on the contents of registers, whereas it can only put bytes into, and take them out of, memory locations. However, we won't be concerned with this arithmetic capability. For the moment, think of registers as places, like memory locations, where we can put 8-bit bytes of data.

The registers in the 8088 are given two-letter names. There are a dozen or so of these registers, but we're going to put off looking at all of them. Our particular program concerns itself with only two of the registers: namely, the DL register and the AH register.

There are four instructions in the program, one on each of the four lines in Figure 8. The first two deal with registers.

The MOV Instruction

The first instruction, MOV DL,01, occupies memory locations 100 and 101 and consists of the bytes B2 and 01 (see Figure 9).

This instruction tells the 8088, "Take the number 01h and move it (MOV for "move") into the DL register." This way of writing the instruction may seem some-

what backwards to you, moving things from right to left. It's a convention that probably had its origin in statements used in higher-level languages, like BASIC's

LET A=2

where the quantity on the right gets "assigned" or put into the variable on the left. At any rate, after this instruction is executed, there will be a byte with the value 1 in the DL register. Where does the 8088 get the 01? It's actually part of the instruction: the second byte. The 8088 microprocessor looks at the first part of the instruction, the B2, in memory, figures out that this means "move the following 8-bit constant into the DL register," and then gets the 8-bit constant from the very next memory location (0101h) and places it in the DL register. The operation of the MOV DL,01 instruction is shown in Figure 10.

When we introduce each assembly language instruction, we're generally going to start with a box that summarizes the ways the instruction can be used, and the MOV instruction—your first assembly language instruction—is no exception. However, you should understand that at

this point you don't need to understand everything that's in the box.

For the purposes of our program, we're only interested in one use of the MOV instruction: the "immediate to register" byte MOV. As you've seen, this means taking a constant two-hex-digit value that is part of the instruction (it "immediately" follows the instruction in memory, hence the name) and putting it in a register. The other uses of this instruction involve MOV(es) to and from memory and from register to register.

Thus for the moment you can ignore most of Figure 11.

The second instruction in our program is also a MOV instruction:

```
0BF1:0102
B402      MOV      AH,02
```

This means, as you no doubt have figured out, "Take the number 02 and MOVE it into the AH register." Because we're moving the constant into a different register, AH instead of DL, the hex code for the instruction is different: B4 instead of B2. And since it's the constant 02h that's being moved into a register, the sec-

ASSEMBLY LANGUAGE

ond byte of the instruction is 02. Otherwise the operation of this instruction is just the same as the first one.

But *why* are we putting these constants in these registers? What does that have to do with printing a happy face on the screen? Fear not, things will become clearer as we describe the next two instructions.

The INT Instruction

INT is a sort of "jump to subroutine" instruction. It stands for INT(errupt), and there are various reasons why it isn't a real "jump to subroutine," but for the time being we can think of it that way. It's a little like a GOSUB in BASIC or a CALL in various other languages. It transfers control from our program to another routine somewhere else in memory. Then, when that routine is done, control is returned to the line following the INT in our program.

So when the instruction

```
08F1:0104 CD21    INT    21
```

is executed, the program jumps to a special part of DOS, a routine whose number is 21h, and when this routine is finished, control returns to the *next* line of the program, the INT 20 at address 106. This is shown in Figure 12. (Remember, this is a simplified view of INT. Actually, the INT instruction involves a transfer to a special address called an "interrupt vector," which in turn transfers control to the routine. However, the effect is much the same as we've shown.)

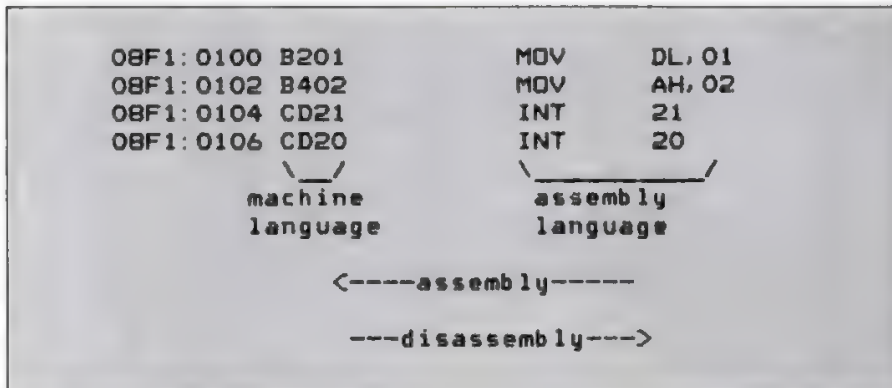


Figure 8: Machine language and assembly language displayed with the U command.

As with the MOV instruction, you can ignore, at least for the moment, a lot of the material in Figure 13.

The Display Output Function

What does this special DOS routine number 21h do? That depends, as we'll see below, on the number in the AH register at the time we execute the INT 21. Routine 21h is a sort of switchyard, which will route us to a number of different DOS functions, depending on the number in AH. In our case, we want to display a character on the screen, so we put the number 2 in the AH register. DOS routine number 21h will then transfer control to the Display Output function, which writes a single character on the screen.

This Display Output routine is one of the famous DOS functions. For the time being, the important things to know about them are that they are assembly language routines built into the PC-DOS operating system (so that they are always available

in memory when you need them) and that they are all reached by executing an INT 21h instruction, with different values in the AH register.

Your program must do three things to cause the Display Output function to actually display a character.

First, it must put the numeric value of the character to be displayed into the DL register. The numeric value for the happy face is 1. (It's like an ASCII value, except that for special characters like the happy face it's not really ASCII, it's a code IBM invented.) So the first instruction in our program puts 01h into the DL register.

The second thing the Display Output function needs is to have the number 2 put into the AH register, as we explained above. This is the number that tells the operating system that we want the Display Output function and not some other function (like the Keyboard Input or Print String functions).

The third thing our program has to do is

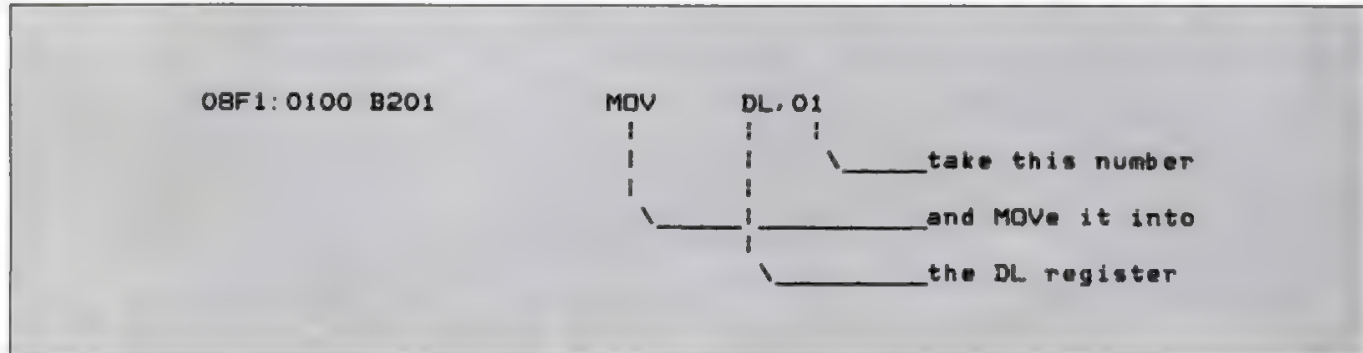


Figure 9: The program's first instruction, MOV DL,01, occupies memory locations 100 and 101.

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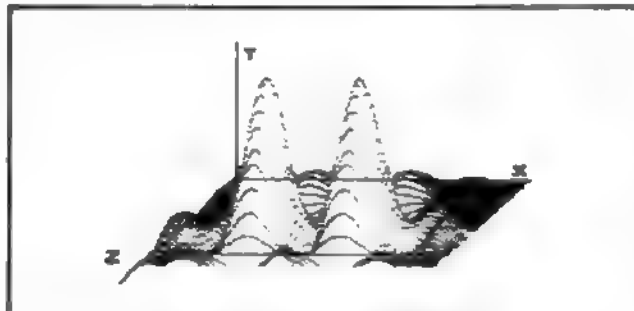
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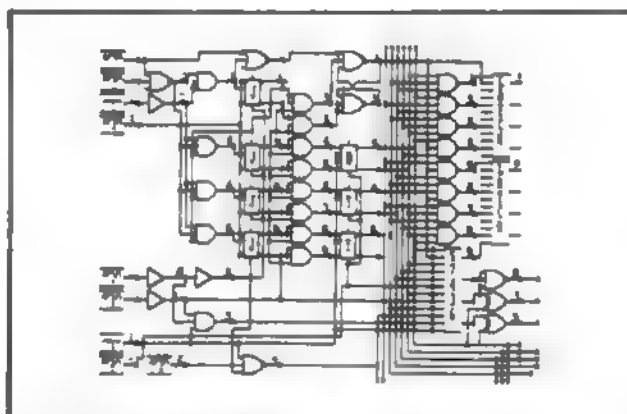
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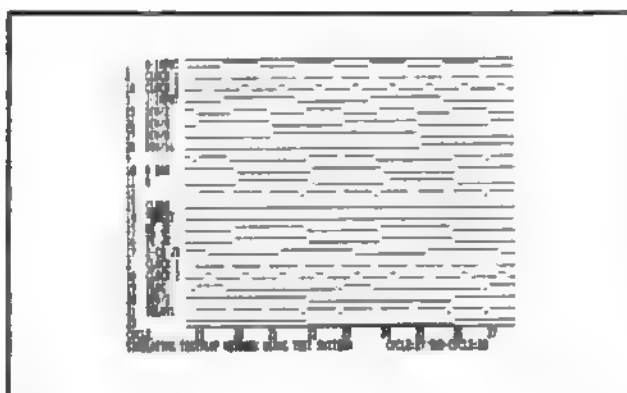
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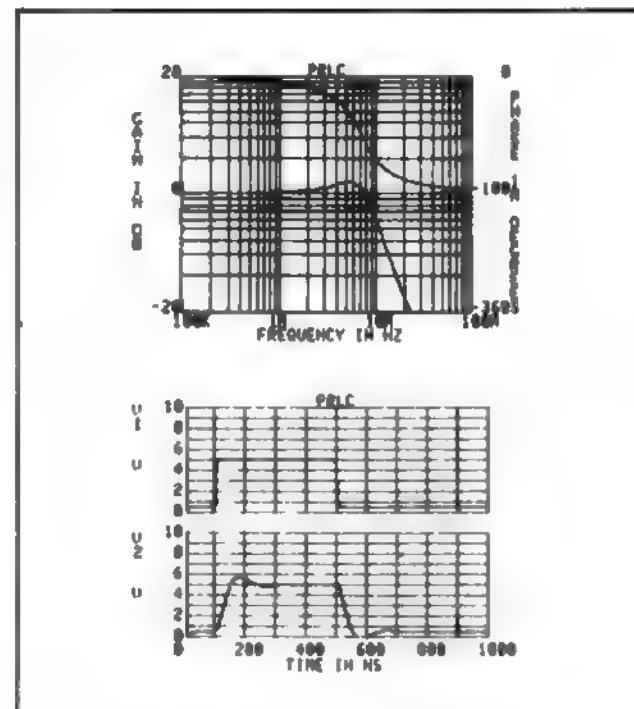
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Getting Started with Assembly Language

Given sufficient motivation and the right equipment, assembly language isn't much harder to learn than other computer languages. And none of them can touch it for raw speed and power.

Assembly language is the fastest and most powerful language available for computers. It is essential in programs where pure speed of operation is important, such as graphics, sorting, and sustained number-crunching. It is also the only language that can make use of *all* of a particular machine's hardware features. With higher-level languages, such as BASIC or Pascal, the programmer is always insulated from the computer by the language itself—you can only do what the writers of the language decided you should be able to do, so inevitably you cannot tap the full power of the computer. Assembly language, in spite of its reputation, is actually not too much harder to learn than any other computer language, provided that it is presented gradually and easily.

The relative difficulty of assembly language is accounted for by its concreteness.

Unlike the more abstract higher-level languages such as BASIC and Pascal, assembly language operates on a very concrete level. It deals with bits, bytes, words (two bytes side by side), registers—which are physical places in the microprocessor where bytes and words are stored—and memory locations, which have specific numerical addresses and specific physical locations in the memory chips inside the PC. Higher-level languages can run on a variety of different computers, but programs written in assembly language are specific to a particular microprocessor chip and, in many cases, to the specific computer that contains the chip as well.

Why learn assembly language on the IBM PC? If you are interested in writing

programs for commercial use, the answer is obvious: The IBM enjoys unprecedented sales growth. If you write a popular program for the PC, you are guaranteed one of the largest markets in the personal computer field. In addition to financial ambition, of course, you may be motivated purely by intellectual curiosity.

Getting Started

The amount of memory you need depends on which assembler you want to use. MASM (Macro ASseMbler), is a full-scale assembler with all the bells and whistles. Its less sophisticated cousin ASM (sometimes called the Small Assembler) is a more modest version that leaves out some of MASM's more advanced features, such as macros and conditional assembly, and as a consequence requires considerably less memory space.

If you use MASM, you'll need a minimum of 96K, though you'll find that 128K is more useful. ASM will run on a 64K system if you are using PC-DOS version 1.0 or 1.1 (although again you will probably be happier with 96K or 128K). However, if you are using DOS 2.0, then you will need a minimum of 96K, with 128K being preferable.

You can use any of the display options available on the PC. And while it's very nice to have a printer, it's not absolutely necessary.

Along with your IBM PC, you'll want to have the *Technical Reference* manual, which is available from IBM. In addition, in order to create the source files for assembly language programs you'll need some sort of word-process-

ing program (any of the popular word-processing programs will do). Add to this a text-editing program, which is one of the utility programs that comes with PC-DOS. Called EDLIN (for E^Dit L^INes), it is adequate for short programs.

Many computers claim to be "IBM compatible," meaning that they will run the same software (and in some cases use the same hardware) as the PC. So do you absolutely have to have an IBM PC? Maybe not—it depends on the particular computer you have, since there are various degrees of compatibility. As a minimum you need a computer that runs the MS-DOS operating system from which PC-DOS, the system used on the PC, is derived.

Along with PC-DOS you get a number of utility programs that are referred to in IBM's documentation as "external routines" (to distinguish them from the "internal functions" built right into the PC-DOS program). One of these programs is DEBUG, which is used to monitor, debug, and edit assembly language programs. Learning to use it is vital to an understanding of assembly language.

Writing with DEBUG

There are two major ways to write short assembly language programs on the IBM PC. The first way is to use the assembler program ASM or its more sophisticated cousin MASM. The other way is to use DEBUG. DEBUG is not really an assembler program. Its primary use is for "debugging" (that is, fixing the errors in) assembly language programs. But you can write short assembly language programs with DEBUG.

Why would you want to? First, DEBUG is a much easier program to operate than the ASM or MASM assembler programs. To type in and execute a program using DEBUG requires calling up only DEBUG itself. Using an assembler, on the other hand, involves using a text-editor, the assembler itself, a program called LINK, and often another program called EXE2BIN. Each of these programs requires a rather complex series of commands to make it work.

The second advantage is that programs written with DEBUG require less "overhead" than those written with the assembler. This overhead comes in the form of program statements that must appear in the ASM "source file," but are not necessary in DEBUG—so by using DEBUG you avoid having to start your day with a lot of incomprehensible program lines.

Third, using DEBUG puts you in closer contact with what is *really* going on in your computer. Besides being useful for assembling programs, DEBUG is also used to examine and modify memory locations; to load, store, and start programs; and to examine and modify registers (reserved storage areas). In other words, DEBUG is designed to put us in touch with various physical features of the IBM PC.

DEBUG has features that make it possible to get down to the most fundamental level of your computer's operation (short of opening up the cover and probing about with meters and oscilloscopes). Sooner or later, if you write programs in assembly language, you're going to have to learn to use DEBUG.

—Barbara Krasnoff

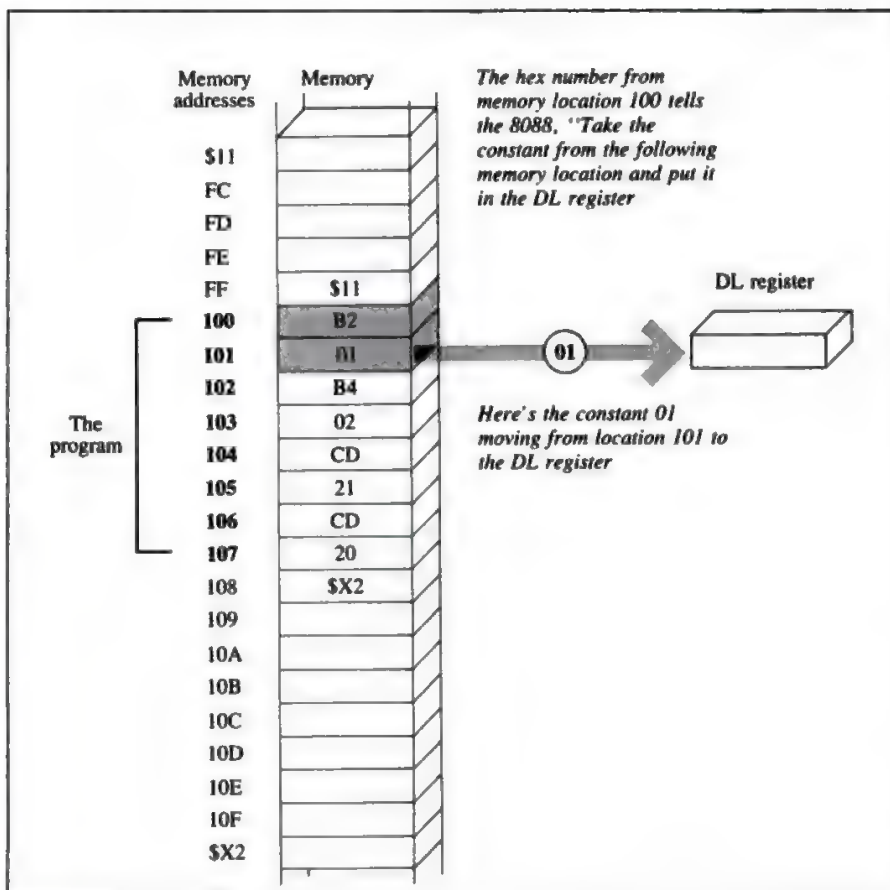


Figure 10: The operation of the MOV DL,01 instruction.

execute the INT 21 instruction itself, so that control will be transferred to the operating system, which will then look in the AH register to figure out what we want to do, namely, display a character.

As we do with assembly language instructions, we're going to summarize each DOS function in a box. In the case of DOS functions, however, most of the contents of the box should be familiar to you.

The instructions that make up the Display Output routine are not in the same place in memory as our program (see Figure 14). In fact, we actually don't know where they are, and we don't need to know. The hardware in the 8088 will take care of transferring control from the CD21 instruction in our program to the beginning of the operating system, and then getting back to our program when the operating system has told the Display Output

routine to print the character from the DL register.

Whew—what a lot of complexity in one little instruction. Perhaps Figure 15 will help make it clearer.

The Program Terminate Interrupt

The last instruction in the program is another INT instruction, this time to DOS routine number 20h.

08F1:0106 CD20 INT 20

This routine is much simpler than DOS routine number 21h, in that there's only one thing it can do. Therefore, you don't have to put anything in any of the registers before you call it. The routine is called the Program Terminate Interrupt (see Figure 16). Its job is to ensure that, when a "user program" (such as the one we've just written) has finished executing, it correct-

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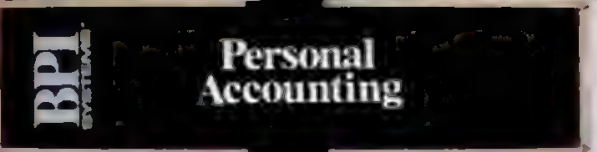
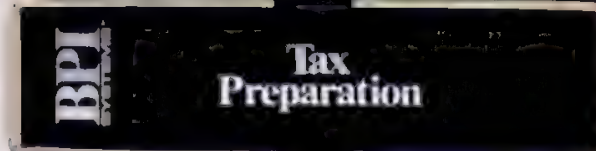
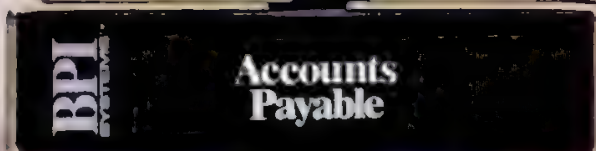
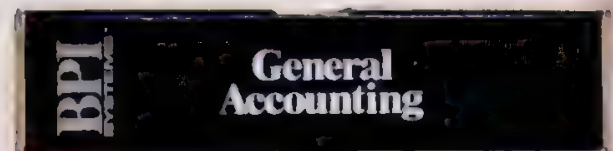
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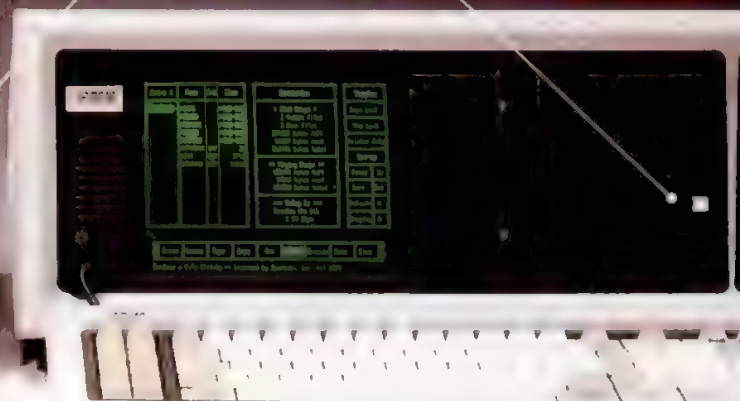
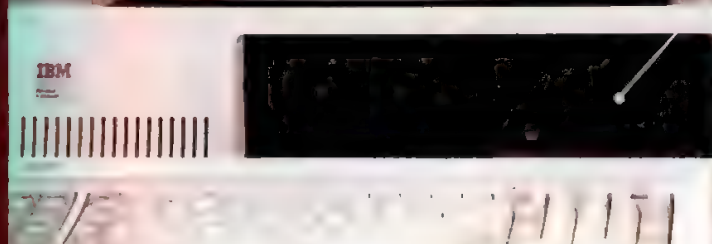


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ASSEMBLY LANGUAGE

ly transfers control back to DOS or DEBUG, whichever is being used to run the program (in this case DEBUG).

Thus, the INT 20 instruction is very similar to a STOP or END instruction in higher-level languages. When the INT 20 instruction has done its work, control goes back to DEBUG, and you get the "program terminated normally" message and the DEBUG prompt.

VARIATIONS ON A THEME

Now that we have our program up and running, let's try changing it a little here and there to see what happens. This should give you more understanding of how the program works.

Printing Different Characters

What modifications to this program do you think we would need to make it display some other character, say the letter X, instead of the happy face? That's right: all we need to do is change the first line, so that instead of MOV(ing) a 1 (the happy-face code) into the DL register, we move a 58h, which is the ASCII code for X.

Assuming that your program is still in memory (if it's not, type it in again with A or E), use U to look at it again:

```
-U100 107
08F1:0100 B201 MOV DL,01
08F1:0102 B402 MOV AH,02
08F1:0104 CD21 INT 21
08F1:0106 CD20 INT 20
```

All we need to do is change 1 byte in this program to make it print an X. That's the 01 at location 101. We could do this using A and simply assemble a new instruction,

```
MOV DL, 58
```

right over the top of the old one at location 100. But since we only need to change 1 byte, let's use the E command instead.

We want to change the byte at location 101 from 01 to 58h, so we enter E followed by that address (see Figure 17).

Since we want to put only 1 byte into

```
*****
* MOV Instruction      Moves byte or word
*                      from/to register/memory/immediate
*
* Move immediate value to register
*     MOV DL, 01      ; byte
*     MOV AX, 1234    ; word
*
* Move immediate value to memory
*     MOV MBYTE, 12   ; byte
*     MOV MWORD, 1234 ; word
*
* Move Register to Register
*     MOV DL, BL      ; byte
*     MOV AX, BX      ; word
*
* Move Register to Memory
*     MOV MBYTE, BL   ; byte
*     MOV MWORD, DX   ; word
*
* Move Memory to Register
*     MOV CH, MBYTE2  ; byte
*     MOV AX, MWORD4  ; word
*
* Flags affected: none
*****
```

Figure 11: Summary of the MOV instruction.

Step 1: CD21 is executed, and the CD21 instruction tells the 8088, "Get your next instruction from routine #21"

Step 2: Routine 21 is run and when finished, it tells the 8088 to get its next instruction from the location following CD21

Step 3: The microprocessor returns to the next line of the program

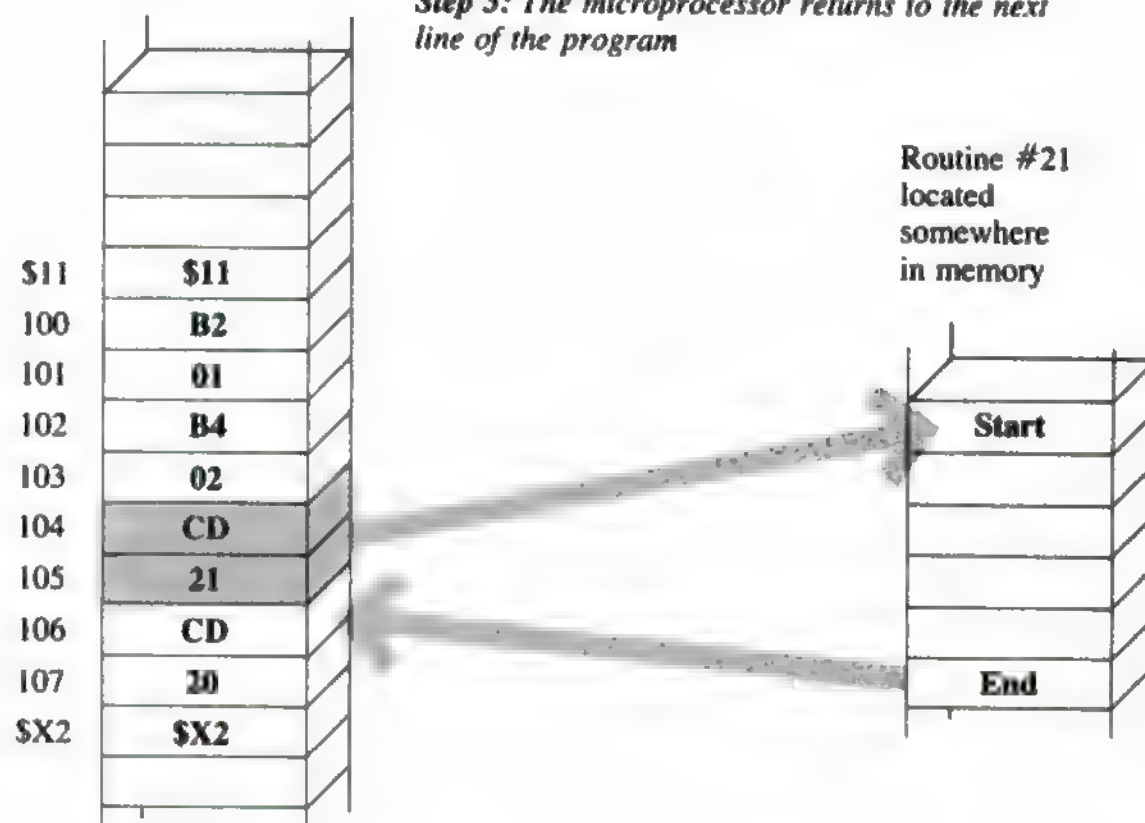


Figure 12: Operation of the INT 21 instruction.

ASSEMBLY LANGUAGE

memory, we press Enter immediately following the byte.

So we've changed the 01 to a 58h. If we list the program again with U, we'll see the change incorporated in it:

```
-U100 107
08F1:0100 B258 MOV DL,58
08F1:0102 B402 MOV AH,02
08F1:0104 CD21 INT 21
08F1:0106 CD20 INT 20
```

Now if we run it again with G, we should see an X displayed on the screen:

```
-9
X
Program terminated normally
```

Not bad! It worked again. By looking up the ASCII values of various characters, you can change the program to print whichever one you want.

The Endless Loop

Let's do one more variation on this program. Suppose instead of printing *one* character we wanted to print a whole *series* of the same character. How would we modify the program to do that? It's not hard: We put a "jump" instruction at the end of the program that takes us to the beginning, so that our Display Output function will be repeated over and over.

Let's also go back to the happy face—it's more upbeat than the X. Put the number 01 back into location 101:

```
-E101
08F1:0101 58.1
```

to restore the happy face.

Now we'll install a new instruction in our program. This instruction goes at the end of the program, overlaying the INT 20 instruction at location 106. It's a "jump" to the beginning of the program, at loca-

tion 100, so the program becomes an endless loop.

If you're using DOS version 2, enter A106, and when the address is printed, enter JMP 100. Then on the next line, hit Enter again to go back to DEBUG.

```
-A106
08F1:0106 JMP 100
08F1:0108
```

If you're running DOS version 1, you'll have to type in the hex code for this instruction using E (see Figure 18). The hex code is EBF8h.

Now disassemble the program to make sure it looks right:

```
-U100,106
08F1:0100 B201 MOV DL,01
08F1:0102 B402 MOV AH,02
08F1:0104 CD21 INT 21
08F1:0106 EBF8 JMP 0100
(continued)
```

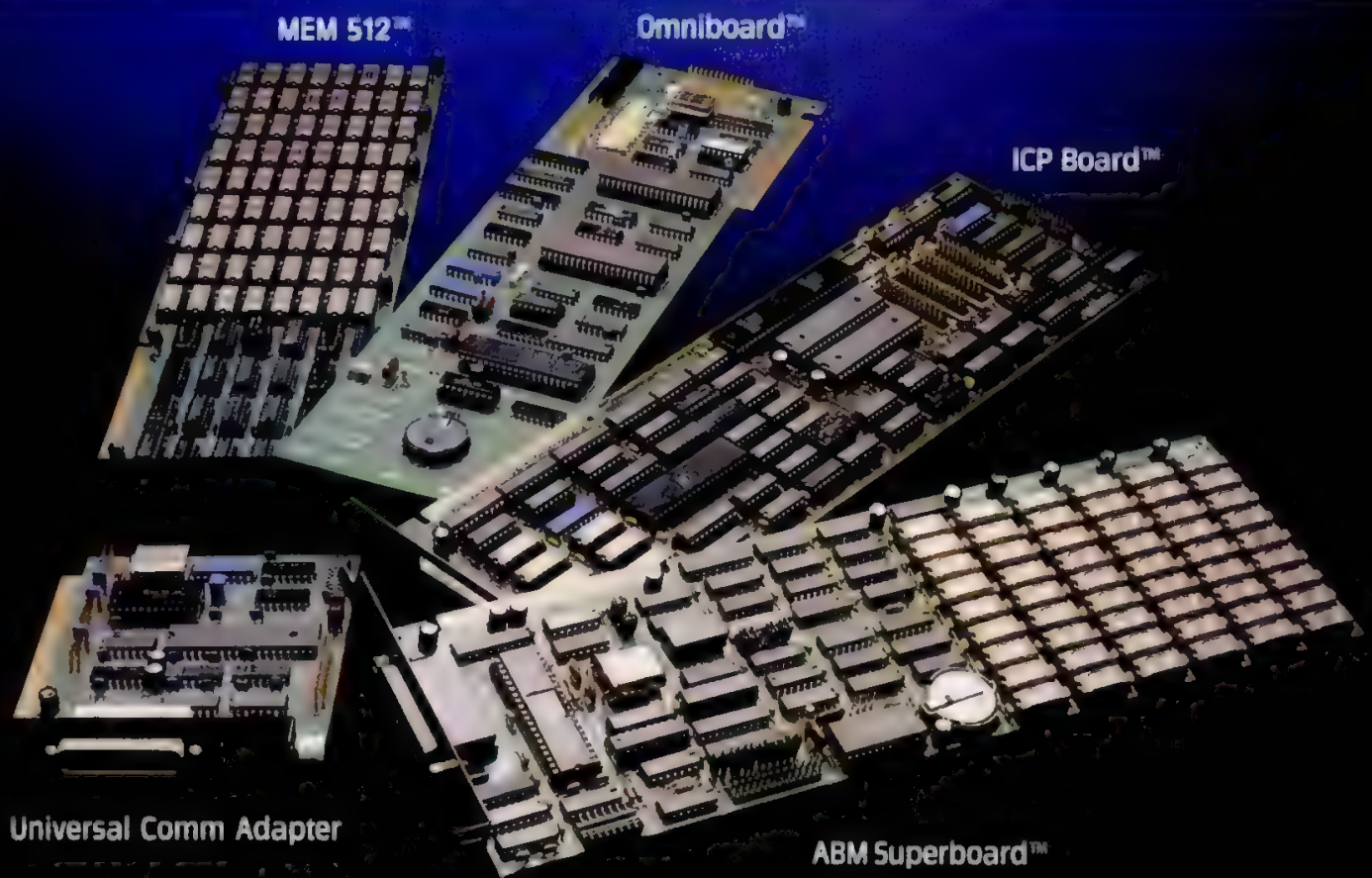
```
*****
* INT Instruction          Calls a routine pointed to *
*                          by an interrupt vector    *
*                          *                          *
* Control is transferred with an indirect call      *
* through any of the 256 interrupt vectors          *
* located from absolute address 00000h to          *
* 00400h. The address of the routine, in           *
* segment:offset form, must be in the vector       *
* * * * *
* Control is returned to the calling program from  *
* the routine with the IRET instruction             *
* * * * *
* Flags affected: IF, TF                             *
* * * * *
*****
```

Figure 13: Summary of the INT instruction.

```
*****
| DISPLAY OUTPUT Function Call          Number 02h (2d) |
| * * * * *                             |
| Enter with: Reg AH = 2                 |
|              Reg DL = ASCII value of character |
| * * * * *                             |
| Execute:      INT 21                   |
| * * * * *                             |
| Return with:  character displayed on screen |
| * * * * *                             |
| Comments:     CTRL-BREAK causes exit from function |
| * * * * *                             |
*****
```

Figure 14: Summary of the Display Output routine.

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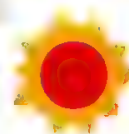
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CIRCLE 204 ON READER SERVICE CARD

ASSEMBLY LANGUAGE

The JMP Instruction

Again, we're showing a box (Figure 19) containing the summary of the JMP instruction. You can ignore most of it at this point.

Let's look at the JMP instruction a little more closely to see how JMP 100 gets assembled into EBF8. You don't need to remember the details of this process, but it will give you some idea of what DEBUG's A command (or the assembler) has to figure out to arrive at the correct machine language equivalent of a particular assembler language instruction.

The first two hex digits that make up the instruction are EB, which is the code for a "short" jump. What does the F8 mean? You might expect to see the address 100 that we're jumping to, but you don't. This is because the jump is a *relative* jump. Instead of using the *address* of the place we're going to jump to, JMP uses the *distance away* [from the current location] of the place to be jumped to.

Even after you know this, the F8 still doesn't make much sense. There are two reasons for this. The first is that since the jump is *backwards*, the number of bytes that need to be jumped is *negative*. If we were going to jump forward 8 bytes, the instruction would simply be EB08. But since we're going to jump backward 8 bytes, we form a negative number by subtracting 8 from 00. If you had FF and added 1 to it, you'd get 00. So if you have 00 and you subtract 1 from it, you get FF. Subtract 1 again and you get FE. Counting down until you've subtracted 1

eight times gives you FD, FC, FB, FA, F9, F8.

But what have we jumped 8 bytes *from*? This brings us to the second reason the F8 is confusing: It doesn't tell you to jump 8 bytes from the jump instruction itself, it tells you to jump 8 bytes from the byte *following* the jump instruction. That would be from location 108 to location

100, which is in fact 8 bytes. Expressed arithmetically, this looks like

$$100h - 108h = F8h$$

Fortunately the A command (and the assembler programs ASM or MASM) do all these tedious calculations for us, so that we don't even have to think about the hexadecimal representations of instruc-

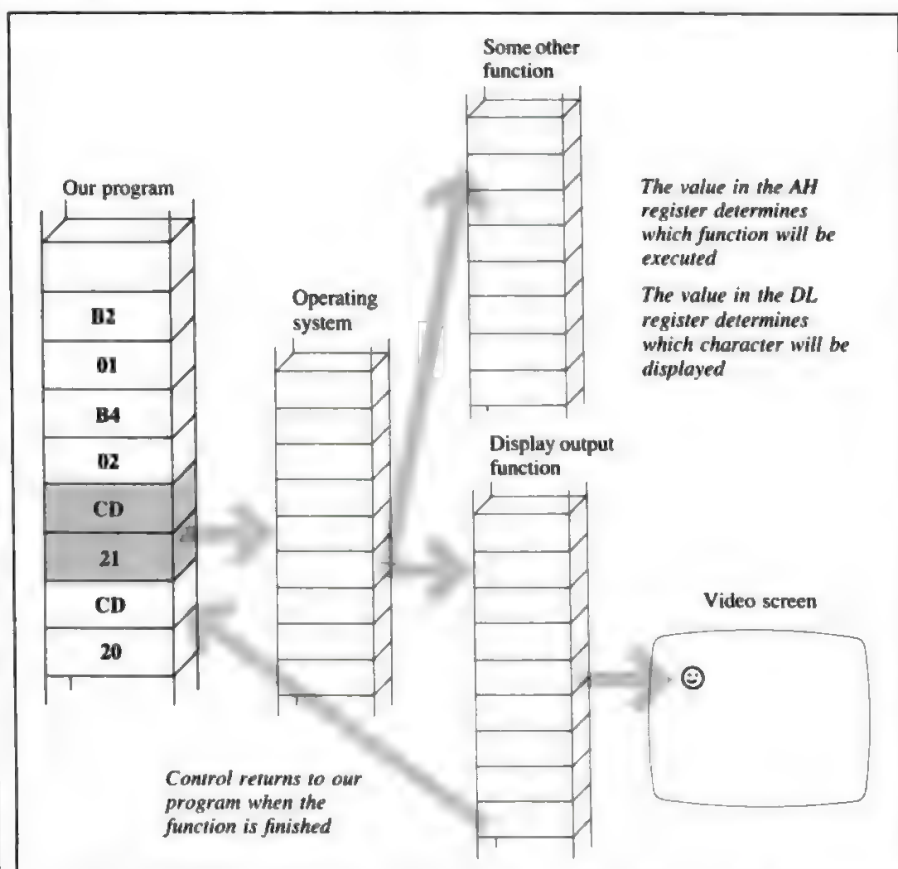


Figure 15: The operating system and related functions. Control shifts from the program to the operating system to the Display Output routine and then back to the program.

```
*****
: PROGRAM TERMINATE Interrupt                               Number: none
: Enter with: -----
: Execute:      INT 20
: Return with: control returned to supervisor program:
:              DOS or DEBUG
*****
```

Figure 16: The Program Terminate Interrupt instruction.

ASSEMBLY LANGUAGE

tions—unless something goes wrong.

DOS version 1 users are at a disadvantage here, since they have no easy way to start with the assembly language mnemonics and end up with the machine language numbers, at least not using DEBUG. Thus, if version 1 users were trying to figure out the hex equivalent of the JMP 100 instruction so they could type it in, they'd either need to go through the calculation

just described, or else try to figure it out by trial and error, guessing a number and then using U to see if it were right.

Out of the Endless Loop

Have you waited all this time to try the new program? Good—that shows admirable restraint.

Try it now. Enter the G command:

—G

Wow—look how fast the screen filled up with happy faces! All right, now stop the program. How do you do that? Just hit Ctrl-Break (the Ctrl and Break keys together) as you would for any other program, and presto, we're back in DEBUG. This is possible because the Display Output function is programmed to look for Ctrl-Break at the same time it's printing characters on the screen. We can thus tell

(continued)

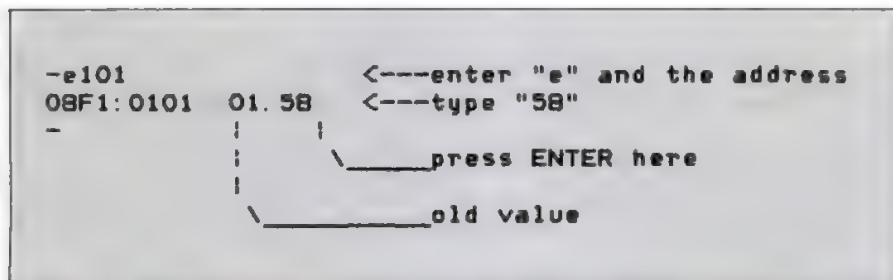


Figure 17: Changing the byte at location 101 from 01 to 58h using the E command.

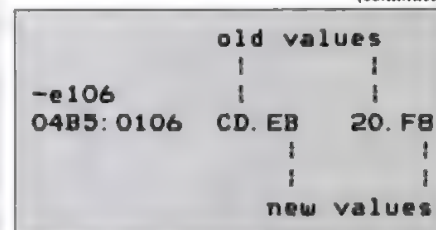


Figure 18: Installing a "jump" to the beginning of the program to create an endless loop, using DOS version 1.

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ASSEMBLY LANGUAGE

```
*****
* JMP Instruction      Jumps to new memory location *
* Within-segment short jump. to address within -128 *
* to +127 bytes      *
*      JMP NEAR_LABEL *
* Within-segment long jump. to address in same      *
* segment            *
*      JMP NEAR_LABEL *
* Intersegment jump: to address in a different      *
* segment            *
*      JMP FAR_LABEL *
* The last two types can also be "indirect jumps," *
* that is, jumps to the memory address contained *
* in: a memory address, a register, or a memory *
* address modified by a register.                  *
*      JMP WORD_VAR *
*      JMP AX *
*      JMP ADDR_PTR [BX] *
*****
```

Figure 19: Summary of the JMP instruction.

```
AX=0201  BX=0000  CX=0000  DX=0001  SP=FFEE  BP=0000  SI=0000  DI=0000
DS=0BF1  ES=0BF1  SS=0BF1  CS=0BF1  IP=0106  NV UP DI PL NZ NA PO NC
0BF1:0106 EBF8                JMP      0100
```

Figure 20: Hitting Ctrl-Break returns you from your program loop to DEBUG and this screen display.

it, "Stop! Don't print that character—I want to get back to DEBUG!"

When you escape from your program back to DEBUG, you'll get a display like Figure 20.

Don't worry about what all this means at this point. You might note, however, that the last line of the display contains one of the instructions from your program, in this case the JMP 0100. This shows what instruction was being executed at the time you pressed the Ctrl and Break keys.

Perhaps this is a good time to end this lesson in assembly language, with the screen (mostly) full of happy faces. ■

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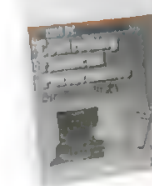
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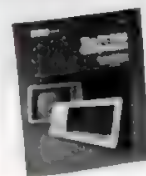
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CIRCLE 134 ON READER SERVICE CARD

A Taxing Question: Exemptions For User Groups

After a 15-month, precedent-breaking battle, a computer user group finally wins tax-exempt status—but only after a face-to-face meeting with officers from the Internal Revenue Service.

When fighting for tax exemptions from the Internal Revenue Service, computer user groups often feel they are tilting at a gigantic windmill. As often as user groups have submitted applications for nonprofit, tax-exempt status, the IRS has turned them down. Recently, however, after a long, lonely battle, one user group realized what seemed to be an impossible dream: It *won* its case against the IRS. For other user groups seeking tax exemptions, the Capital PC User Group case may serve both as a model and an inspiration.

Today, Capital PC User Group, Inc., based in Silver Spring, Maryland, is thriving. Its 2,400 members teach software classes at local universities, hold meetings, staff a PC repair hotline, maintain an electronic bulletin board, sell disks of software programs or utilities contributed by

members, and run a software-buying group.

When the group's treasurer, Jimmie Faris, began her campaign for tax-exempt status in May 1982, the group was 2 months old and had only 30 members. Because some of her professional work as an accountant had been with nonprofit organizations seeking tax-exempt status, Faris thought she might be able to win the same status for the newly formed Capital PC group. Not only would the tax exemption save money, it would also make Capital PC eligible to use meeting spaces in public buildings at virtually no cost. Obtaining tax-exempt status was thus a serious matter.

For the IRS too, the granting of tax exemptions is a serious matter. In 1982, the agency handled over 50,000 applications from organizations for tax exemp-

tions. Of these, 75 percent were approved. More than 12,000—or about 23 percent—of the applicants gave up midway through the process, and in 1,510 cases, requests were formally denied.

No one tracks the number of rejections and withdrawals related to computer user group applications. Even the most avid computer buff would find it difficult to monitor the fate of user group applications to the IRS since the IRS does not break down its ever-expanding list of 841,000 tax-exempt organizations into categories. Until now, however, the odds against user groups have unquestionably been steep. Indeed, Ruth Ann Barrett, a California-based consultant who counsels user groups, says Capital PC is the only group she knows of that has succeeded in getting a tax exemption.

User groups apply for nonprofit, tax-

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A TAXING QUESTION

exempt status under the IRS's 501(c) statutes. According to Faris, the sections of the IRS code best suited to user groups are 501(c) (4), for social service organiza-

tions, and 501(c) (7), for social clubs. (Another exemption, 501(c) (3), for charitable organizations, makes dues tax-deductible for members. Ernie Acosta, an

IRS spokesperson—and, incidentally, a member of an Osborne computer user group—says that although some groups have attempted to apply under this clause,

A Chronology Of Pitfalls

The Capital PC User Group's campaign for tax-exempt status lasted 15 arduous months.

In this tangled tale of bureaucratic ineptitude and official cooperation, almost every foul-up on the part of the IRS is requited by helpful examiners who earnestly attempted to show Capital PC treasurer Faris how to make IRS rules work in her favor. The saga may offer user groups seeking tax exemptions a road map of the pitfalls ahead.

March 1982: The user group forms with about 30 charter members.

May 1982: In a step not strictly necessary for tax exemption, Faris registers Capital PC as a corporation. She sends articles of incorporation and bylaws to the Maryland State Department of Assessments and Taxation.

In Capital PC's first official contact with the IRS, Faris files a request for an Employer Identification Number.

June 1982: Faris submits Capital PC's application for tax-exempt status under section 501(c) (7) to the IRS regional office in Baltimore, Maryland. The application includes the lengthy form 1024 (Application for Recognition of Exemption), copies of the articles of incorporation, bylaws, and financial statements, and the group's request for an Employer Identification Number.

July 1982: The IRS returns Capital PC's application, claiming that it is incomplete. The request for an Employer Identification Number has been lost, it seems. In addition, the bylaws are improperly "conformed." (Although copies of organization bylaws submitted along with form 1024 do not have to be notarized, the signatures of the board of

directors must be clearly legible on a high-quality xerox. On Faris's form, apparently, they are not.) Faris has 1 month to resubmit Capital PC's tax exemption paperwork.

August 1982: Faris sends a new application for tax exemption with a letter saying she will provide any additional information the IRS requires.

In an encore of its earlier performance, the Baltimore IRS office returns the application as incomplete. This time, the bylaws and articles of incorporation are missing.

Faris resubmits form 1024.

September 1982: The Capital PC tax exemption application is now complete, the IRS says. After 5 months, review of the application begins.

October 1982: The IRS releases its preliminary findings. Since the Capital PC budget projections show that income from newsletter advertising and software sales will more than equal revenues from membership dues for 1982 through 1983, the examiner doubts the group will qualify as a nonprofit recreational organization under section 501(c) (7). In addition to asking detailed and helpful questions about the benefits that members will receive, the letter asks for an explanation of volunteers' nonprofit activities that do not appear in the group's budget projections. Faris has 3 weeks to answer the IRS objections.

November 1982: Capital PC responds to the IRS queries.

December 1982: Faris calls for information on the progress of her case. An

IRS examiner explains that the group's advertising and software sales will still block approval of the Capital PC social club. At the examiner's suggestion, Faris asks for new consideration as a "civic league or social welfare organization" under section 501(c) (4), a classification that better reflects the group's educational activities.

January 1983: Because of its complexity, Capital PC's case is referred to the national IRS offices for a ruling.

February 1983: With no final decision from the IRS, Faris prepares to file income taxes as if Capital PC is indeed a tax-exempt organization. The IRS is still reviewing the user group's case, but early findings are again unfavorable. The application is unlikely to be approved.

May 1983: Still convinced that Capital PC is primarily a cooperative buying group saving money for individuals, the IRS turns down Faris's request for tax-exempt status under 501(c) (7) and 501(c) (4). Faris has 21 days to file a formal protest.

Reluctant to file an official protest, Faris wangles an informal meeting with two IRS officials. Her reiteration of Capital PC's educational activities is at last convincing, and the officials ask for another letter explaining Capital PC's good deeds. The IRS agrees to reconsider its negative ruling.

August 1983: Capital PC's application is approved. Capital PC is now recognized as a tax-exempt civic league or social welfare organization under section 501(c) (4) of the IRS code. —K.C.

A TAXING QUESTION

they do not qualify.)

The basic financial criterion that determines which of the two 501(c) exemptions applies is permissible amount of income. Tax-exempt community service organizations—the class of organizations qualifying under 501(c) (4) exemption—are allowed to earn money but must prove that their most important function lies in performing a not-for-profit service. For user groups, this community activity usually consists of providing free computer education for the public. If the user group is also making money from software or newsletter ad sales, it must prove that such earnings are being channeled right back into its “do-good-activities.”

The “Pleasure” Exemption

A nonprofit tax-exempt social club, on the other hand, has no responsibility to the

public. Under section 501(c) (7), such a club’s activities should be for “pleasure, recreation, or other nonprofitable purposes.” The catch to this exemption is that if more than 15 percent of the club’s income comes from some source other than dues, then the IRS assumes pleasure is no longer involved.

Since income from relatively low-priced dues accumulates much more slowly than profits from software sales or newsletter advertising, the “pleasure” exemption may be difficult to sustain. An exemption under 501(c) (7) could be just right for a small group whose members plan to do little more than get together and swap great software stories. If the group decides to expand the range of its activities, however, the recreational exemption could become a constraint.

If it doesn’t already know, a group

must develop a firm sense of what it is about before it begins the arduous process of filling out the tax exemption form—the dread 1024 with its seven pages of questions covering all aspects of the group’s operation in explicit detail. Many of the questions ask for elaborations of the principles set out in the group’s articles of incorporation and bylaws. Although incorporation, which frees the members of an organization from personal liability for the organization’s debts, is not strictly necessary, the IRS recommends it. The articles of incorporation and the group’s bylaws should be submitted along with form 1024.

Faris filed articles of incorporation and bylaws on behalf of the Capital PC group with the state of Maryland in June 1982. Articles of incorporation spell out the name and the purpose of the corporation

BY THE TIME
YOU DISCOVER
A HORN OUT
DISK, IT'S PROBABLY
TOO LATE.

A TAXING QUESTION

and identify its officers. The bylaws are a more detailed document: They describe the group's power structure, set guidelines for elections, meetings, and membership, and further outline the group's intentions.

For 501(c) (4) applications, Faris found, the IRS examiners are most concerned with whether or not an organization is truly engaged in providing a community service. If a user group wants to establish itself as a social service organization, its bylaws should pledge the group "to provide a forum to increase understanding and utilization of the PC through formal and informal educational, experimental and research programs; to be a medium of communication among user and other PC groups; to form special interest groups (SIGs), and to sponsor a software exchange for public domain and con-

tributed programs."

This statement from the Capital PC group's bylaws, Faris hopes, separates her group from others that are less public-

The bylaws specifically state that we do not condone software piracy.

spirited. "Many user groups, as I understand it, are put together for two purposes," Faris says. "One is to pirate software—user groups are notorious for pirating software—and the other is to form a buying group." According to Faris, one clause in the Capital PC bylaws "specifically states that we do not condone software piracy. We vigorously oppose it."

Troublesome Financial Statements

Incorporation papers, bylaws, and the 1024 form should be sent to the IRS with a proposed budget for the year to come and historical financial statements. These financial statements seem to be the real stumbling block for many user group applications. In the case of Capital PC, the role of the buying group, whose income and expenditures appeared in the financial statement, had to be carefully explained. Although the buying group can get good prices on software for members and does charge a commission for the service, Faris insists the group puts consumerism first: "Our buying group actively tries to get dealers in the area to carry the merchandise at a price that will be reasonable before they even get into the market. If the group can get somebody else to carry it,

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A TAXING QUESTION

they don't even bother." (Even so, the buying group nets some \$5,000 a year from its 5 percent service charge.) Another trouble spot can be ad income from

Faris insisted on meeting in person with IRS officers.

newsletters, reportedly as high as \$50,000 annually for some user groups.

Even when the 1024 has been submitted, the road for user groups remains bumpy. Even Faris, an accountant with considerable experience in seeking tax exemptions, suffered a series of setbacks before the Capital PC application was approved (see the accompanying sidebar, "A Chronology of Pitfalls"). In August 1982, the IRS issued its first ruling against Capital PC. The group was getting 60 percent of its income from software sales, the IRS noted, much too high a percentage to qualify under the 501(c) (7) "pleasure club" rule.

Faris began again, asking to be considered under 501(c) (4), the social service rule. As sometimes happens with difficult cases, the Capital PC application was transferred from the local to the national offices of the IRS. In May 1983, one year after the application for exemption was first filed, the IRS rejected the Capital PC bid once again, charging as before that software sales were bringing in too much money.

Faris, keeping her case alive through sheer determination, insisted on meeting in person with IRS officers. "There is no beating around the bush," she says. "You must be actually formed for educational purposes, and you can't be put together for some ulterior motive." Once again she told them about training seminars, lectures, hotlines, meetings, and a host of other activities. User groups, she insisted, are the most effective way to inform the public about developments in the computer industry.

At last, IRS officials told Faris they thought there had been a "misapprehension" of what the Capital PC group was all about. If she would put her speech about educational purposes into a letter, they would send her application back into the review process. Finally, two months later, in August 1983, Capital PC got its tax exemption as a social service organization.

The case took 15 months to resolve. But in an understaffed office that receives some 50,000 applications annually, such delay is routine, comments IRS spokesperson Acosta.

As might be expected, the paperwork is overwhelming. Faris spent a full week preparing the 1024 documents alone. If Capital PC had paid for a professional accountant, it would have cost several hundred dollars at least, even for the initial stages. Fortunately, most groups have CPAs as members who might be persuaded to do the work gratis.

If the work is done by a member without professional CPA training, a good starting point is Publication 557, *Tax-Exempt Status for Your Organization*, available at local IRS offices. If that doesn't help, call a lawyer, a CPA, or the IRS. And stick it out, advises Barrett. The IRS should have one contact all the way through, she emphasizes. "You can't have Frank do it for one month and then get tired of it and turn it over to Martha, who doesn't know what is going on."

Is all this work worth it for the average PC user group? The answer, as always, is maybe.

Tax-exempt status has helped Capital PC to find a good meeting place. For a fee of \$300, it is allowed to hold one meeting a month in a Department of Agriculture building auditorium. In addition to the space itself, the fee covers air-conditioning or heating and security costs.

For Faris, the tax exemption was originally less important than the advantage it afforded in getting a meeting place. But with 2,400 members paying \$25 a year and with 100 new members signing on

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A TAXING QUESTION

every month, the financial savings keep looking better.

Even if a small group doesn't turn into a giant, the tax exemption can help. As the IRS' Acosta says, "Many small groups probably aren't paying taxes at all. But even with a little club, bills add up over the years. If the IRS investigates, you could be hit with all the back taxes, penalties, and interest charges." So, a tax exemption under club rules might help.

Not even tax-exempt status means a free ride from the IRS, however. Tax form 901 for tax-exempt organizations is "a pain in the neck to file, probably the worst return I ever filed," Faris says. She's still slaving over her checkbook programs.

Furthermore, if the IRS ever decides that not enough of the group's earnings are being used for educational purposes, it may require the organization to file a supplemental 901-T form to account for excess income. (Even the long-exempt Boy Scouts, reports consultant Barrett, were recently forced to pay taxes on money they made running a big Boy Scout supply center in California.) A group that applies for a tax exemption has to be committed to maintaining a responsible profile for a long time to come.

If there's one consolation, it's that Capital PC's hard-won success may make it easier for other user groups to get tax exemptions in the future. "Any time you get this sort of thing established, it will make it easier for other groups," Faris says. "But it's still an ambiguous, subjective judgment, and decisions will be made on a case-by-case basis." Capital PC is trying to make it easier for other groups to benefit from their experience, too. In a perfect mixture of profitmaking activity and nonprofit motive that sums up the dilemma of the user groups, the organization is offering an instructive disk containing copies of relevant letters and documents from its tax exemption case—at a cost of \$6 a disk. To receive your disk, send a check to Capital PC Software Exchange, P.O. Box 6128, Silver Spring, MD 10906. ■

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The FileCommand Mystery

If you think DOS is too simple, this utility program from the folks at IBM will have you scratching your head in bewilderment in no time.

There's an aura of mystery behind *FileCommand*. Months ago, while many of us were panting over the soon-to-come, all-new, menu-oriented DOS 2.0, a usually reliable source stood up at a meeting of our local user group and proclaimed the existence of a new product called *FileCommand*. It was supposed to be a "visual shell" for good old DOS 1.1. Trouble was, you could only get it at a particular IBM Product Center in a distant suburb, and even there supplies were supposedly limited. IBM hadn't even officially announced it yet. The mystery continued. By the next

FileCommand

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meeting, *FileCommand* had apparently disappeared from the face of the planet, and so had our reliable source.

IBM announced DOS 2.0 soon afterward. *FileCommand* was announced soon after that, but I had a devil of a time getting my hands on a copy of the mysterious new program. It was kind of like a classic B-movie plot: *FileCommand* wasn't released; it escaped. But finally a copy escaped into my clutches.

FileCommand comes in an ugly flesh-pink plastic IBM-size binder, and it's subtitled "DOS at your fingertips." Funny, I mused, as I flipped through the manual, I always thought DOS was at my fingertips.

So what does *FileCommand* actually do? I wondered while paging through the manual. After a few hours of fooling around with the program, I finally figured it out. In essence, *FileCommand* is a utility program for those who think DOS isn't complicated enough already and who

want to learn a couple of dozen brand new commands. An easy-to-use "visual shell" it ain't.

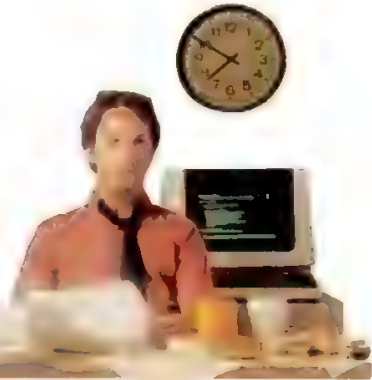
The DOS Prompt Vanishes

You get two versions of *FileCommand* on your distribution disk, one for DOS 1.1 and one for 2.0. If you try to load the wrong one, you get an error message. Once you do load the correct version, it becomes a resident portion of the DOS command processor, so you can remove the program disk from the drive. *FileCommand* takes up, in practice, at least 10K of memory while it's loaded. If you want that memory back, you can cancel the program and it will unload itself.

When you invoke *FileCommand*, your old standby DOS prompt disappears, and, after the usual IBM logo, you see a screen like the one in Figure 1. At the top there's a status line that lists the current default drive; the drive name, free space, and total space of the disk last checked by *FileCom-*

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FILECOMMAND

mand for a directory listing; the total free memory; the number of the line where the cursor is to be found; and the number of files in the directory.

Down on line 25, the function key assignments are displayed in the familiar BASIC-style format. Normally you see the tags for the unshifted keys, but every time you hit Ctrl or Alt, the display magically changes to show you what the function keys mean now. It's a neat trick, and one I haven't seen elsewhere.

The other 23 lines make up what the manual calls the command/display area. Much of that space is given over to directory information. The first 15 columns give the drive name (and, in DOS 2.0, a path abbreviation) and filename. The last 37 columns include indication of H (hidden) and S (system) files, and those delightful 2.0 abbreviations; R (for a file that can be read but not opened for output), A (for a file that has been written to or added since the fixed disk was last backed up), and D (for a subdirectory). You also get the size of the file in bytes, the number of sectors the file occupies, and the date and time of last file creation activity.

If you're dealing with more than 23 files, the command/display area will take up more than one screen. *FileCommand*, however, has no special way of indicating this; the total number of files listed in the upper right-hand corner is the only indication you have that your files are spread over a few screens. It's easy to forget that you're not seeing the whole directory when all you are viewing is a portion.

The Gaping Hole

A gaping hole fills the center of the screen, making it deucedly difficult to figure out precisely which information on the right side of the hole matches up with the stuff way over on the left. Fortunately, one line of the directory information is always highlighted, which will help you figure out what matches up with what. But what about that giant hole in the middle?

That, pilots, is the command area—the

Total Space= 179712 Free Space= 38720 Free Memory= 226192 1 of 24					
ANSI	SYS	A	1664	4	3-08-83 12:00:00
ASSIGN	COM	A	896	2	3-08-83 12:00:00
BACKUP	COM	A	3687	8	3-08-83 12:00:00
BASIC	COM	A	16256	32	3-08-83 12:00:00
BASICA	COM	A	25984	51	3-08-83 12:00:00
CHKDSK	COM	A	6400	13	3-08-83 12:00:00
COMMAND	COM	A	17664	35	3-08-83 12:00:00
COMP	COM	A	2523	5	3-08-83 12:00:00
DISKCOMP	COM	A	2874	5	3-08-83 12:00:00
DISKCOPY	COM	A	2444	5	3-08-83 12:00:00
EDLIN	COM	A	4608	9	3-08-83 12:00:00
FDISK	COM	A	6177	13	3-08-83 12:00:00
FIND	EXE	A	5888	12	3-08-83 12:00:00
FORMAT	COM	A	6016	12	3-08-83 12:00:00
GRAPHICS	COM	A	789	2	3-08-83 12:00:00
IBMBIO	COM	HSRA	4608	9	3-08-83 12:00:00
IBMDOS	COM	HSRA	17152	34	3-08-83 12:00:00
MODE	COM	A	3139	7	3-08-83 12:00:00
MORE	COM	A	384	1	3-08-83 12:00:00
PRINT	COM	A	4608	9	3-08-83 12:00:00
RECOVER	COM	A	2304	5	3-08-83 12:00:00
RESTORE	COM	A	4003	8	3-08-83 12:00:00
RT	EXE	A	1280	3	3-08-83 12:00:00
SYS 2 2017HS DRIVE A DRIVE B DRIVE C SERIAL 7 DADSUE BPPDSUE BSA - 200010					

Figure 1: The basic FileCommand screen. The hole in the center is the command area.

Total Space= 179712 Free Space= 38720 Free Memory= 226192 1 of 24						
A:	BASICA	COM	A	25984	51	3-08-83 12:00:00
A:	COMMAND	COM	A	17664	35	3-08-83 12:00:00
A:	IBMDOS	COM	MSRA	17152	34	3-08-83 12:00:00
A:	BASIC	COM	A	16256	32	3-08-83 12:00:00
A:	CHKDSK	COM	A	6400	13	3-08-83 12:00:00
A:	FDISK	COM	A	6177	13	3-08-83 12:00:00
A:	FORMAT	COM	A	6016	12	3-08-83 12:00:00
A:	FIND	EXE	A	5888	12	3-08-83 12:00:00
A:	EDLIN	COM	A	4608	9	3-08-83 12:00:00
A:	IBMBIO	COM	MSRA	4608	9	3-08-83 12:00:00
A:	PRINT	COM	A	4608	9	3-08-83 12:00:00
A:	RESTORE	COM	A	4003	8	3-08-83 12:00:00
A:	BACKUP	COM	A	3687	8	3-08-83 12:00:00
A:	MODE	COM	A	3139	7	3-08-83 12:00:00
A:	COMP	COM	A	2523	5	3-08-83 12:00:00
A:	DISKCOPY	COM	A	2444	5	3-08-83 12:00:00
A:	RECOVER	COM	A	2304	5	3-08-83 12:00:00
A:	DISKCOMP	COM	A	2074	5	3-08-83 12:00:00
A:	ANSI	SYS	A	1664	4	3-08-83 12:00:00
A:	TREE	COM	A	1513	3	3-08-83 12:00:00
A:	SYS	COM	A	1408	3	3-08-83 12:00:00
A:	RT	EXE	A	1280	3	3-08-83 12:00:00
A:	ASSIGN	COM	A	896	2	3-08-83 12:00:00
1 of 24						

Figure 2: FileCommand sorts instantaneously by size, as shown here, or by date (the default), name, or extension.

place where you enter DOS and *FileCommand* commands. A cursor appears in the command area of the highlighted line, the only place you can do any typing. The up and down arrow keys move the cursor and

the highlighting through the directory. If there's more information tucked away on previous or subsequent screens, the arrow keys scroll the listing up or down when the cursor reaches the top or bottom of the

FILECOMMAND

screen. If not, the cursor jumps to the top or bottom of the current screen.

With *FileCommand*, most of the keys work in more or less standard fashion. Ctrl-End erases the current line of the command area to the right of the cursor. Esc clears the whole line, and the Home and End keys take you to the beginning or end of the line. The backspace, Del, PgUp, PgDn, and left and right arrow keys do about what you would expect. Ctrl-PgUp and Ctrl-PgDn take you to the first or the last page of the directory, respectively.

The Enter and tab keys each move the cursor to the first position of the next command line. Shift-Tab does the reverse; it moves you up one line.

The really important command, though, is Ctrl-Enter. It's a new combination to me; you use it to execute com-

mands you've entered. The gray plus key (or another key you designate) functions the same way.

If a command you type extends beyond column 41, *FileCommand* eases the file information to the right to give you more room for your command. If you change your mind, the information in the right-hand column does not return.

Enter the Slasher

You can type two different things into the command area: commands to DOS and commands to *FileCommand* (and, as we'll discover, some commands to DOS) begin with a slash.

The first set of these slash commands involves sorting the current directory. Want a directory in order of file size? Try /ss (see Figure 2). For dates, it's /sd. Either way you get the listing in descending

order, biggest files or most recent dates first. There's no way you can put your files in ascending order with these two parameters.

And there's no way to get descending order if names are your game. The command /sn puts your files in alphabetical order by name, and /se does the same thing by extension. Since you can combine directories from more than one drive or path, you can also sort them that way using the command /sp.

To change the directory, use /r for replace, which gives you the directory for the last drive you viewed; /r x: for the directory for drive x; and /r filespec or /r path-name for a directory of a particular filespec or path. You can enter global characters, such as /r b:* txt, in the filespec.

So far, none of this seems overwhelmingly useful. Things begin to get more

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FILECOMMAND

interesting for hard disk users with the /R / command, which gives you a directory of the current line. If it's a plain vanilla file, you get a one-line directory. But put that command on a line that's got a subdirectory name, press Ctrl-Enter, and voila! You get a listing for that subdirectory.

The process is not exceptionally forgiving, though. Forget the space after the /r and you get a directory of the default drive. Order up a directory with no files and you get the message "Empty . . . Set," an appropriate description of the programmer's mind on the day he chose this error message.

Think you've gotten all you can out of this directory madness? Wait! There's more! You can merge directories into each other, though the program calls the process "appending" and makes you use /a to do it. The parameters are similar to the

ones we've discussed already. If you're working with two different versions of a file in two different drives, you can find out which version is more recent with this command.

DOS 2.0 users may find the path display handy.

You can also exclude file entries from the directory, but only by inserting /x on the current line. If you try to exclude another file, or a whole bunch of them by entering a parameter after the /x, *FileCommand* ignores all the parameters you've entered. That rules out omitting all your .BAK files, for example.

DOS 2.0 users may find the path display

handy. Let's say you append a subdirectory called "section1" by entering /a section1. *FileCommand* will keep track of that, and any other subdirectories you've called up at the same time, by replacing the colon of the drivename with a lower-case letter: Ab, Ac, Ad. If you want to find out what the abbreviations stand for, give a /p command and you get an inverse video answer at the bottom of the screen:

Ab=>A:\section1

Ac=>A:\section1\section2

and so on. I guess it's no more confusing than the usual path craziness. Remember, none of the *FileCommand* commands are executed until you hit the Ctrl-Enter combo or the gray plus key or its surrogate.

So much for directory foreplay. Now it's time for "DOS at your fingertips." If you enter DOS commands in the com-

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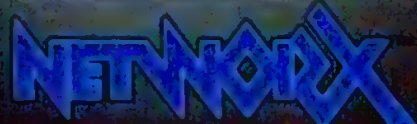
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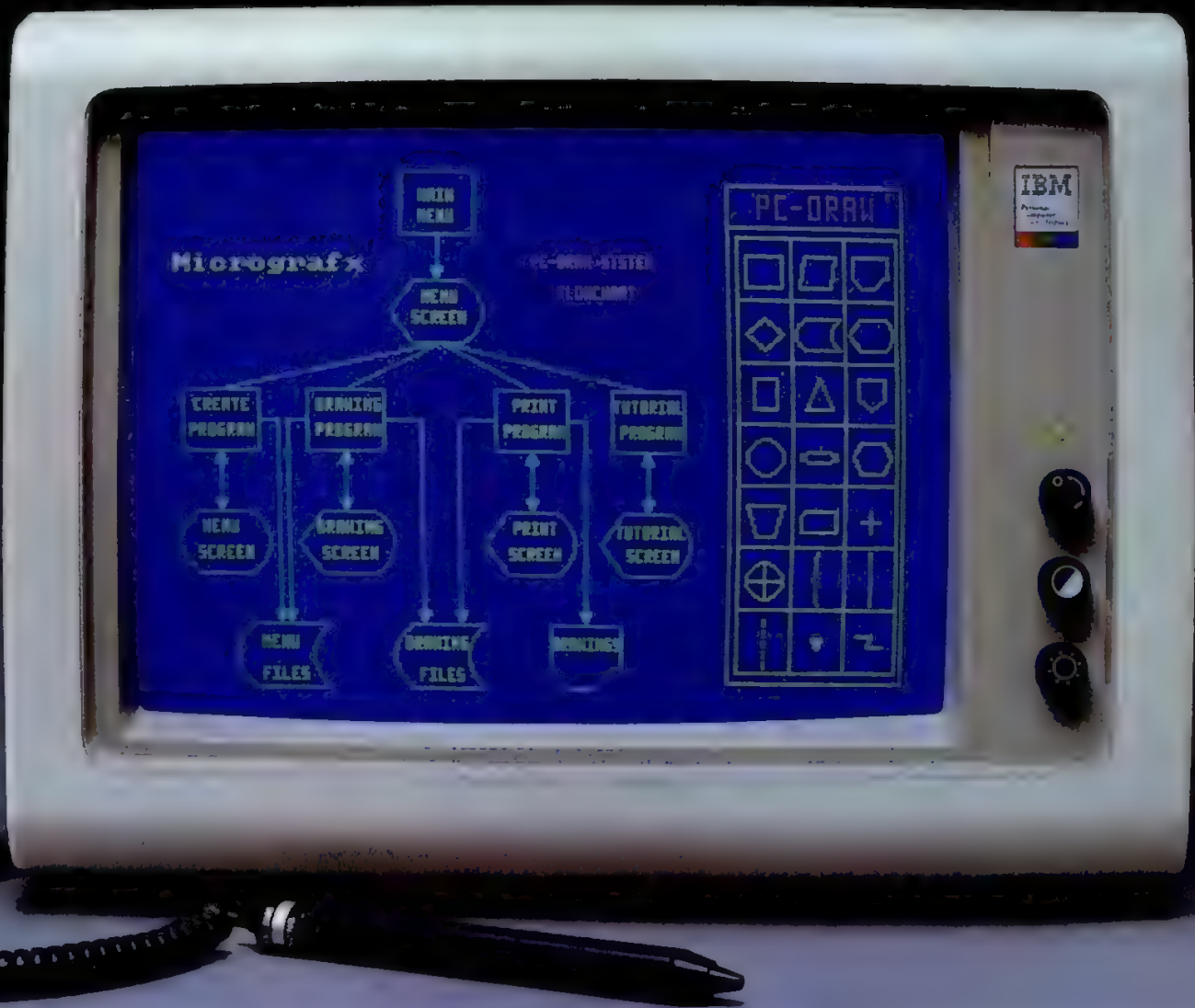


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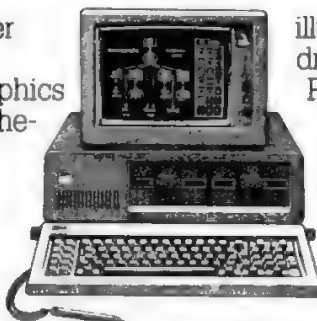
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FILECOMMAND

mand area and press Ctrl-Enter, the *FileCommand* screen clears. The DOS commands are then carried out in the order they appeared on the *FileCommand*

FileCommand can be invoked with a whole passel of parameters.

screens. When DOS is done, you get its familiar prompt along with a blinking block cursor. The function keys then revert to their normal DOS modes and you can enter normal DOS commands.

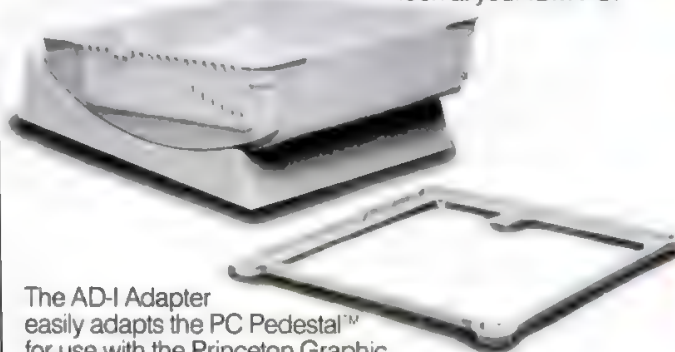
Hitting Enter in response to the prompt takes you back into the *FileCommand* world, where your old directory awaits you. All the commands you entered are still on the screen, but they're no longer highlighted. If you decide that you want to reenter any of them, retyping one character in a command will instantly bring it back to highlighted life.

What you'll probably prefer to do, though, is use /r to "refresh" the *FileCommand* display. This brings back excluded file entries, clears the command area, and updates the current directory after you've used DOS to rename, erase, create, or copy files. Even if you have erased a file from a disk, its filespecs will still appear in an unrefreshed *FileCommand* directory, and newly added files won't. That's not exactly what you'd call "transparent to the user."

Nor, in fact, is entering a DOS command from *FileCommand* transparent. First you have to consider what *FileCommand* is going to do about it. Normally, for example, the filespec on the current line is added to the end of the command you type in. If you type ERASE next to the file A:JONES.BAS, then pressing Ctrl-Enter wipes out old Jonesy. If you want to enter a pure DOS command such as COPY A:FILENAME B:, you have to type /o first. The other catch is that it's one line, one command; *FileCommand* be-

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haves as if you hit the Enter key at the end of each command line.

If you want the filespec on the current line to be included somewhere in the command other than at the end, you enter a slash. Entering copy \b: on the command line next to A:YAHOO.SIR and hitting Ctrl-Enter will copy that file to the B drive.

You can also invoke .EXE and .COM (and, undocumented by the manual, .BAT) files directly from *FileCommand* by typing a slash on the proper line and hitting Ctrl-Enter. If you put a bunch of slashes on successive lines, *FileCommand* will execute all the programs, one after the other.

There's a mess of other options that you are highly likely to misremember. Using /dn from the current line replaces the drive letter and filename; /d inserts just the drive letter, /n just the filename, and /e the extension (but not the period—you have to use ./e for that). To run a batch file with a replaceable parameter, for example, you could move the cursor to the line representing the batch file and then type /n PARAMETER Ctrl-Enter. If the parameter was a filename, you could also move the cursor to the line for that filename and type in BATCHFILENAME Ctrl-Enter.

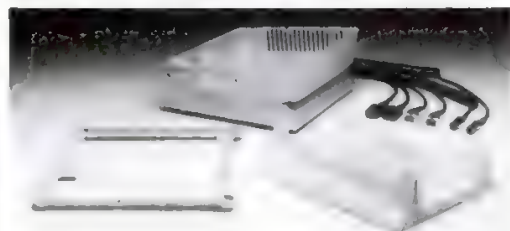
Down The Drain

When using its own replace, append, or omit option—or a DOS command and the slash—*FileCommand* doesn't add the filespec to the end of a command. Likewise, once you've used the /o command, *FileCommand* ignores the slash, /dn, /d, /n, and /e. If a DOS command requires a slash, you replace it with two slashes.

To repeat the previous DOS command, you type an equal sign (=) into the command line. This method will not repeat a *FileCommand* command, but it's a quick way to do, say, a FIND across a whole disk. Entering an invalid command gets you nothing more than a beep and what ASCII fans will recognize as CHR\$(191), a right angle character, apparently sym-

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FILECOMMAND

bolizing effort gone down the drain.

You can display the last DOS command you issued by typing a question mark in the command area and pressing Ctrl-Enter. *FileCommand* shows you the command without highlighting it. To light it up again, you type over any character in the command. You use two question marks to get the next-to-last DOS message. If the command in question was a *FileCommand* function, you get the beep and angle error message.

Confused? Me, too. Fortunately, there's a way to check up on what will happen if you enter a particular set of commands. You simply type REM before whatever you have in mind. *FileCommand* passes the REM out to DOS along with the rest of the command. It's sort of a kludgy preview function.

And believe me, you'll need it. *FileCommand* omitted an item essential to every program: a stop key. Once you've hit Ctrl-Enter, there's no way to get *FileCommand* to quit, short of performing a three-key reset. I accidentally entered the wrong FIND command at the top of a directory, followed by 95 equal signs, and watched with irritation as *FileCommand* made 96 futile disk accesses. The irritation might have turned to sheer terror had I mistakenly stuck an equal sign after an Erase command.

More Key Evidence

Want to reassign the function keys? That's okay by *FileCommand*. Just remember that F1-F10 in any of their shifted forms will immediately execute any commands assigned to them. The Alt-alphabet keys just put a command up on the current line; they won't do a thing until you've pressed Ctrl-Enter.

But if you happen to press one of the function keys, not only do you get the function assigned to the key, you also execute the other commands you entered in the command area. As usual, *FileCommand* scans its screens from top to bottom, and the function you've pressed will be executed in its proper place. If there's

FILECOMMAND

already a command typed in on the current line, it will be ignored.

To get a complete list of the key assignments, you Ctrl-Enter /k, which gets you three successive screenfuls of information. To change the key assignments you must cancel *FileCommand* with a /c command, then reinvoke it with the *FileCommand* /u command—which, as the manual forgets to remind you, requires you to put the *FileCommand* disk back in the default drive. You may reassign any function key or Alt-alphabetic key. When you're done, you get a chance to reassign the alternate Execute key and then save the changes to disk. If you want to back out, you have to use Ctrl-Break.

The manual gives you examples of sample key assignments, and the program comes with built-in defaults, such as REFRESH for a new pass at the directory, and BASICA, which will invoke a .BAS program on the line for which it is pressed. My guess is that the function key reassignments could be most useful to get at paths and subdirectories on a hard disk.

Down the Garden Path

FileCommand can be invoked with a whole passel of parameters. If you're a DOS 2.0 user, you can send it down the garden path to create the directory you want. You can start it up just for a particular filespec. And the Amazing /q option, should you remember to invoke it at startup, will actually let you get past the opening IBM logo screen without hitting the space bar. With /u, you tell the program you want to change the key assignments on your way in. Finally, you can choose the startup sorting method by using the same /s command you use from inside the program. Otherwise, the default is a sort by date.

Finally, but most importantly, you can and should reserve space for a certain number of directory entries. Each entry takes up 46 bytes of memory. By default, room for only 64 file entries or the number of files in your default drive (whichever number is larger) is reserved if you omit

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FILECOMMAND

the parameter. That causes no end of problems if the directory of a nondefault disk has more than the maximum number of files. You can't append to a full directory, and you may not even get a complete directory of the disk in question. A beep warns you of the problem, but there's no specific error message connected with it, and despite what the manual promises, the infamous CHR\$(191) does not appear. I fooled around with the program for hours before discovering, on page 48 of the 52-page manual, what the beep meant. Fortunately, you can change the default permanently.

There's also a limit to the number of directories, subdirectories, and filespecs you can append. The default is 8, but you can go up to 15. Again, this default can be modified for keeps.

The reason the defaults are so small is that increasing them eats away at memory. Every file added to the maximum number chews up 46 additional bytes, and every directory or filespec munches another 16 (79 in DOS 2.0). A table on page 51 of the manual lets you figure it out. But unless you're using a machine with 64K RAM or a program that requires every last byte of memory, I can't imagine large parameters creating any problem.

The manual cryptically notes that *FileCommand* must be the last resident extension of the DOS command processor currently in memory before it can be cancelled. Apparently, this means it should be loaded last, after such things as keyboard enhancers, spoolers, and fake disks—none of which IBM recognizes. I loaded it after *SuperDrive*, *ProKey*, and *WordStar* to no apparent ill effect. *FileCommand*, incidentally, can be copied. It will work from an AUTOEXEC.BAT file.

The Final Mystery

Sure, I can see some nifty ways this thing can work. As I mentioned, it was very handy for a disk-wide FIND. You could conceivably get a date-sorted directory at the end of the day, then go through a whole mess of copy commands with

equal signs and have *FileCommand* execute them all at once. But the Backup function of DOS 2.0 does this already (will somebody please find me a simple program that does exactly what that program does, but for diskettes?). And for months I've been using a public-domain directory sorting program that's not as fancy as this one but certainly suffices for my needs.

I suppose folks with DOS 2.0 and lots of subdirectories might find *FileCommand* useful, particularly its ability to append and sort directories to see what's out there in fixed disk heaven. But in many ways this program is overly complex and confusing, and it requires learning a whole new set of commands. One truly annoying aspect of *FileCommand* is the way it can execute a bunch of commands you didn't intend, because they appear on a screen of the directory you forgot to look at. An important function that's missing is a simple key that will clear all the command lines without executing any of the commands. As it stands, you have to check each line to make sure it doesn't contain anything you didn't mean to include there. A couple of simple help screens, or even a quick reference card, would also have made life with this program much, much nicer. And the omission of a Stop command is absolutely intolerable.

Yes, this program makes certain things easier. Theoretically, it's delightful to be able to move the cursor to a particular line, hit a function key, and watch the file get copied, just like that. But which method really is easier: finding BATCHFILENAME by moving the cursor through a multi-page directory and then typing /n PARAMETER, or simply typing BATCHFILENAME PARAMETER?

The visual shell awaits, folks. *FileCommand* is not a terrible program; it worked and didn't produce any unseemly errors while I played with it. But the real mystery is why IBM bothered releasing it instead of giving us a genuinely user-friendly operating system. ■

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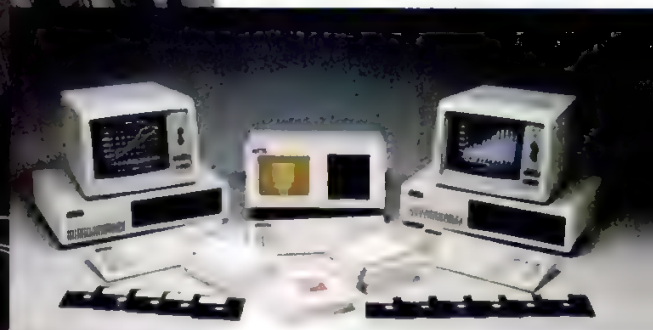
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CIRCLE 168 ON READER SERVICE CARD

A Secret Inside The ROM

Sandler ruminates about the importance of keyboards, and PCjr's keyboard in particular. He reveals a secret and brings us the latest in entry devices, a six-key board that does it all.

Ah, keyboards. Can't live with them and can't live without them.

Many of us who write about microcomputers really couldn't give a bouncing baud over the nature and brand of the latest CMOS microprocessor or VLSI graphics controller in the new Model 6SJ7 PC-compatible super-duper computer and coffee-maker. All this is just fodder for the computer technoids. We writers want to know what it can do for us. We're interested in knowing how to work our computers, not how our computers work.

But gather any two electronic microjournalists (we used to be called "ink-stained wretches" when I first broke into newspaper business) at the bar of a trade show hospitality suite these days, and all you've got to do to touch off an argument is mention the word *keyboard*.

Take the IBM PC keyboard—please. For some of us, it is Big Blue's biggest blunder. The keys are in the wrong places; it has a touch possessed of all the subtlety of a diamond cutter with a bad case of the hiccups and makes a noise that sounds like a rusted-out Corvair crossing a triple set of Chesapeake & Ohio railroad tracks at an imprudent rate of travel.

But then there are those who simply cannot stand the other extreme—the whipped cream contacts of the Compaq, Columbia, and many of the other pretenders to Big Blue's throne.



And I'm not even going to get into the whole argument about the disadvantages of the so-called Qwerty keyboard. (In case there's one reader left who hasn't heard the tale, the QWERTY arrangement, which gets its name from the first six letters in the top alphabetic row, was introduced in a deliberate attempt to slow down the early users of the typewriter, who had been jamming the keys too readily.) There is an alternative layout, with its own band of proselytizers, called the Dvorak keyboard. And if you really want to be arcane, I worked my way through college as a printer, often tripping my fingers across the Linotype keyboard, which had a home row of ETAOINSHRDLUC.

What brings all this to mind, though, is the current round of verbal fisticuffs among chip-stained wretches and between

these wretches and IBM. In November, the company finally unveiled its Peanut home computer, which turned out to be neither called Peanut, nor aimed solely at the home market. But who ever accused rumormongers of telling the whole truth and nothing but?

Not Amused

On the morning after the Big Announcement, I was summoned to appear on a national morning television news show to give 31.2 seconds' worth of appraisal of the PCjr. I said all kinds of nice things about the machine and praised IBM for maintaining compatibility with the huge PC-DOS software library and for its continued commitment to quality of construction. And then I tossed off a mild rebuke about the input device, calling it a "Chiclet" keyboard and describing it as neither wonderful nor terrible, but certainly a bit odd.

Big Blue was not amused.

Well, I've got a little more than 31.2 seconds here, so let me go on: The PCjr's keyboard is neither fish, nut, nor fowl. It has all of the necessary keys for PC compatibility, and the spacing of the keytops has the same $\frac{3}{4}$ inch separation as that of any other typewriter, but the appearance, feel, and sound is—well, different.

Okay, so I raised IBM's corporate blood pressure a few points when I spoke

SANDLER'S SCREEN

of "Chiclets." "Not true," it squawked. "Who said keytops have to be square?" it asked us. "These just happen to be rectangular, and we think they're quite nice." Like Chiclets.

The next thing we computerized scribblers did was complain that our clumsy little fingers kept slipping off the ASDFGHJKL:" row where they belonged and that our usual furious pace of 12 words a minute had dropped to a shameful 7. And the touch—well, one wag said it was like massaging fruit cake. Personally, I found it more like jamming Plastic Wood into nail holes in my latest attempt at making another bookshelf for my home office, and that is not my favorite task in life.

"Well, the test group of secretaries we had try out the PCjr keyboard for us said they loved it," IBM replied. "And they started out and finished at 55 words per minute."

Peanut Butter Proof

Then we thought we really had them when IBM began talking about the advantages of its "rubber dome technology," which serves as the ultimate peanut butter proofing for any keyboard yet devised. This didn't impress us a bit until we realized that this would also mean that a spilled Scotch or a tumbled Tanqueray would do our PCjr keyboard no harm—perhaps it might lubricate the word machine a bit. Now that's an argument sure to please the heart of many an electronic hacker.

Well, we could see that this argument could lead only to an unhappy conclusion: 25 rounds of "The quick brown fox jumped over the lazy sleeping dog," at 20 paces. Then almost by accident we made a little discovery.

I was down in Boca Raton doing some almost nondestructive testing of the PCjr with a few of the writers from that other magazine where I now hang my hat, *PCjr Magazine* (on sale now at newsstands or by subscription) when we found a deep, dark secret buried in Junior's ROM.

Yes, folks, IBM will defend its decision to go to the strange 62-key PCjr pea-

nut butter proof, fruitcakelike, Chiclet-topped keyboard. But we found inside the ROM a diagnostic test to check out the functioning of a (gasp!)—83-key keyboard, one that looks just like the keyboard I'm clacking along on now to write

IBM will defend its decision to go to the strange 62-key PCjr peanut butter proof, fruitcakelike, Chiclet-topped keyboard.

this column.

What does this mean? Only time will tell, but one thing for certain is that IBM has left its options open. Another keyboard for the PCjr may emerge: there could be a PCjr workstation, or there just might be a flood of upgraded keyboards from other quarters of the multibillion dollar subindustry spawned by IBM.

All of this, though, is mere chewing gum when it comes to the plans of an American/British Company called Microwriter, which has abandoned the entire Qwerty keyboard, scorned the Dvorak alternative, and eliminated 77 keys from the PC board!

The company's device, also called Microwriter, has only six keys, but with it you can write all of the words and numbers you will ever need, with one hand.

What these hopeful, hardworking capitalists are promoting is a 2-pound handheld word processor about the size of a paperback book. With a \$499 pricetag, it has a 14-character liquid crystal display and 8K of nonvolatile memory that can store about five pages of double-spaced text. Its programming includes a text editor with capabilities for typing, inserting, deleting, and formatting. It also offers serial communications for dumping text to a printer, modem, an IBM PC, or a micro-cassette for storage. (It is available from Microwriter (U.S.A.), Inc., 17 East 71

St., New York, NY 10021.)

The Microwriter is said to be a reasonable success in the United Kingdom, with more than 1,000 sold already. It is making its American debut this year.

This new product is exciting for its implications about the future of the portable office. But we're gathered here to argue about the keyboard, and this one is a real red herring: six keys for every letter of the alphabet, all ten numbers, most common ASCII characters, and a set of commands for word processing. It works, obviously, through combinations of keys in a system that proved unexpectedly easy to learn.

The device, produced for now in a right-handed version only, has a platform shaped to fit the hand quite nicely. There are four keys spread across the top, which match the typical lengths of the index, middle, ring, and little fingers, respectively. There are fifth and sixth keys in easy striking distance of where the thumb would fall. You are asked to "draw" the letters through key combinations; a J-shaped combination of keystrokes for example, produces the letter J on the screen. It sounds complicated, but is not. Despite my years of QWERTY-pounding, I was able to click along at about 10 or 15 words per minute.

I tried it and I sort of liked it. It's a great way to meet women or start conversations with unusual folks on the 5:44 to Croton-Harmon. Here I was clicking away on this funny-looking brown package. One of my seatmates one evening was convinced it was one of those table-top *Pac-Man* games.

Anyhow, it remains to be seen whether Microwriting will replace Qwertying (I wonder if it will plug into the PCjr?). But I did have a wonderful thought: I'm going to ask the Microwriter people to come up with a left-handed version of the machine for me. Then I could sit on the couch at home and write my column with one hand and a chapter for my next book with the other. As long as the left hand didn't know what the right was doing, I could meet all of my deadlines. ■

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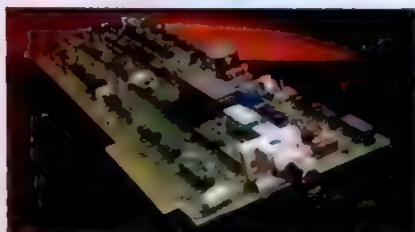
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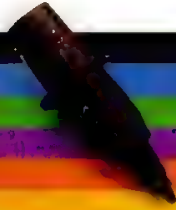
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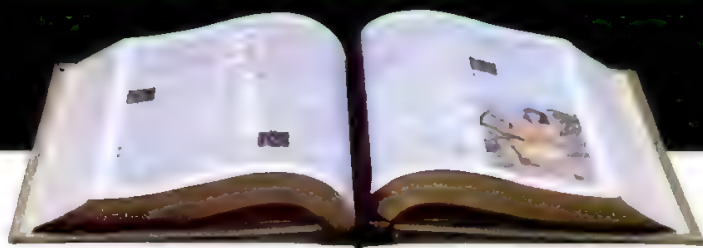
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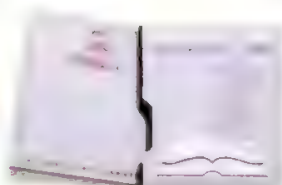
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PC MAGAZINE • FEBRUARY 21, 1984

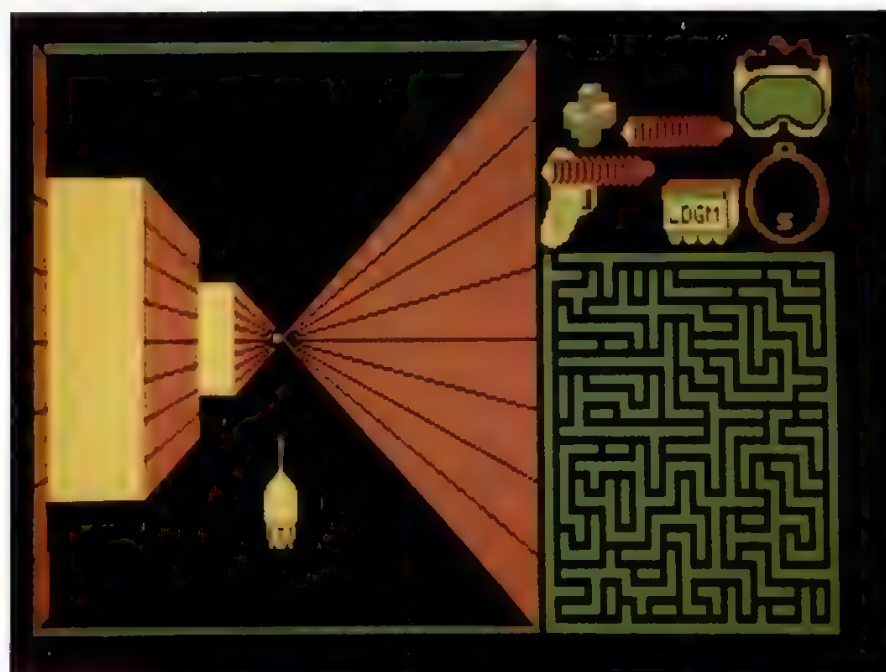
Mental Gymnastics in the PC

Two new games for the PC offer adventure and excitement in a gold mine maze, and team fun in a computer version of the television classic, Concentration.

This is my first column for *PC*, and I'm excited to be here. *PC Arcade* will now offer in-depth reviews of simulation, adventure, war, fantasy, and other nonarcade games, in addition to the usual arcade favorites.

The IBM PC is no toy when it comes to playing games. It is a machine with large memory capacity, capable of impressive graphics and good sound effects. These capabilities will be kept in mind, particularly when reviewing software that was originally designed for another system. After all, it is important that even game software utilize all the advantages of the PC.

Shultz's Treasure may not ring as an appealing title, but this is one program that maze/action fans will be delighted to own. If you like the Hall of Mirrors at the amusement park, where every turn looks strangely familiar, you'll love roaming the



Shultz's Treasure displays a pigeon-hole view of hallway and walls (left) and an overall view of the maze (right). The player can select the background colors.

Shultz's Treasure

Computer Easy
414 East Southern
Tempe, AZ 85224
(602) 829-9614

List Price: \$34.95

Requires: 64K RAM, one disk drive, PC-DOS 1.1, color graphics board, and color or monochrome monitor with graphics adaptor.

CIRCLE 760 ON READER SERVICE CARD

hallways of *Shultz's Treasure* as much as I do. It is cleverly constructed, attractively designed, and thought provoking. It reinforces the skills of orientation and map reading on multiple levels.

The title screen presents game options, which include the choice to play from the keyboard or with a joystick, with or without sound, and you can select various background colors. The player can also

save and load games in progress. *Shultz's Treasure* offers 7 different skill levels.

Two-thirds of the screen displays a first-person, pigeon-hole view of the maze, which recedes nicely into the background, creating the illusion of depth. The remaining third of the screen displays an overhead view of the entire maze with a dot that indicates your position.

The object of *Shultz's Treasure* is to

PC ARCADE

roam the hallways in search of hidden gold, fighting off attacking creatures and picking up useful tools along the way. To be successful, the gold must be blasted out of the walls and carried back to the starting point of the maze.

Fortunately, when you select an easier level of play, you will be equipped from the start with a gun for defense, night goggles (essential to see anything in the maze), an overhead map with pathfinder dot, a compass, an ore detector to pinpoint the gold, dynamite to uncover it, and a mining car to haul it back. On the most difficult level, the player starts out with only a gun and mining car. Until you stumble across the night goggles, you can't see a thing.

Creatures

Of course, you are rarely alone in the halls of *Shultz's Treasure*. Creatures, such as bats and dogs, fly or walk toward you, getting larger as they approach. At this point either you get it or it gets you. The game would pose little challenge without these creatures, but bear in mind it's gold you're after—don't waste time looking for a fight.

Of the many creatures, bats are your worst enemies because their sole object is to bump into you and steal your possessions. You'll realize how devastating this can be the first time one steals your pathfinder, and the dot representing your position on the map disappears! Stolen possessions are dropped in a random maze corridor and remain there until you run across them again. A list of your possessions appear in the upper right corner of the screen.

Creatures other than bats will not steal your physical possessions; they will just sap your strength. If one of them gets too close to you, the screen will briefly flash red, and a bar at the top representing your strength will shrink. The game is over when the bar disappears.

The Ore

In addition to watching your position

on the overhead map, there is one other important item to monitor—the ore detector. This little box begins to fill up with gold color the closer you get to the location of the gold. It will turn solid red when your character reaches the exact spot where the dynamite should be dropped to uncover the ore. If you are successful, the ore will automatically be loaded into the mining car.

The maze itself is intricate and too large to easily memorize. Furthermore, the maze for each new game is randomly generated from among 10,000 possibilities, which makes *Shultz's Treasure* highly replayable.

On PC's game rating scale of one to six, *Shultz's Treasure* rates:

FUN:	4.5
CHALLENGE:	5.0
GRAPHICS/SOUND:	4.0
TOTAL:	13.5

Match Wits

CBS Software
One Fawcett Pl.
Greenwich, CT 06836
(203) 622-2500

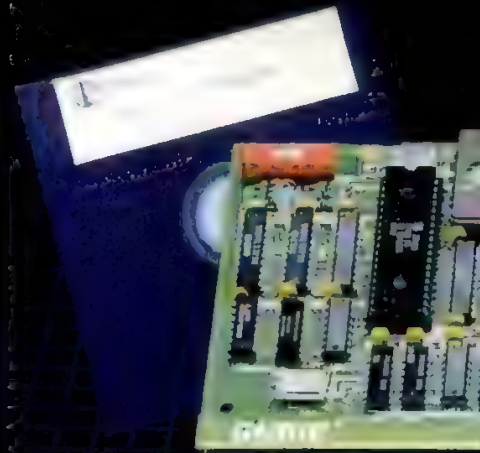
List Price: \$29.95

Requires: 64K RAM, one disk drive, PC-DOS 1.1, color graphics board, and color or monochrome monitor with graphics adapter.

CIRCLE 759 ON READER SERVICE CARD

Match Wits is a computerized version of the classic television game show "Concentration." It accommodates a large group of players at one time, by splitting them into two teams. *Match Wits* is equally challenging when played alone, but not as much fun; the solitaire player has to take turns for the imaginary player.

To begin a game, each player types in a team name so the computer can identify which player is to move next. Then a list of six general subject categories appears: Sports, Words, Cities, Famous People, Multiplication, and Animals. Selecting a category causes three subcategories to



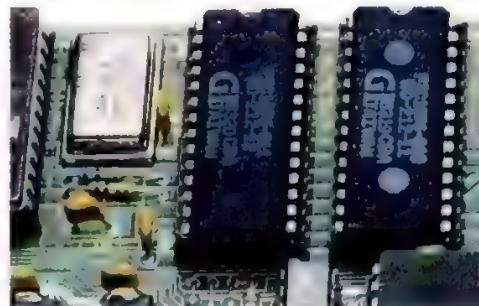
Flip the pages. You see PC modem cards with fewer features advertised for as much as \$599. Up until now that's how much it cost to make a modem capable of transmitting at 120 characters per second (1200 baud). It doesn't take a computer to figure out the savings in phone line charges when you communicate four times faster than the 30 character per second modems (300 baud). Now you can have the solution to your communication needs at an affordable price.

SEE HOW THEY WORK

You can image how precise the components have to be to convert tones over a phone line into 120 characters every second. Precision equates to cost. With the advent of the mass market in personal computers the economies of scale drove the costs of manufacture down, but did not effect the precision required. The technology used is called "analog filtering". It is the process of sending (modulating) and receiving (demodulating) tones with perfect pitch. A lot of adjusting, noise suppression, and a little magic is required. Real expensive. Some use lots of chips and filters (known as discrete components). The latest rage is LSI (Large Scale Integration) technology. Which is the same old analog stuff condensed onto fewer chips.

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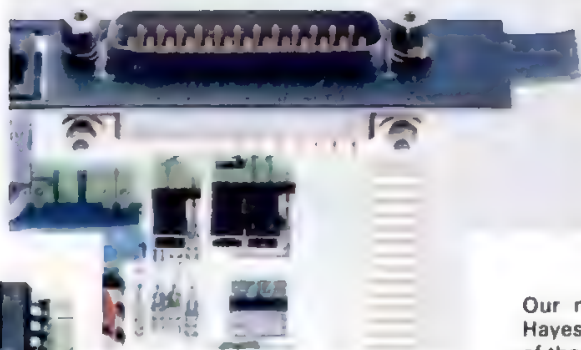
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ADVANTAGE #2

Optional external serial port connector



AN ASYNCHRONOUS ADVANTAGE

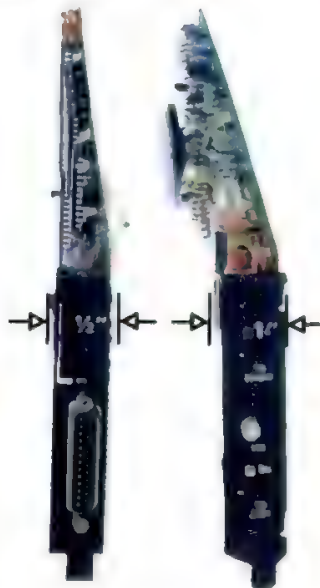
The modem board is addressed in the software as COM1 or COM2 and we have a handy little option you ought to consider. If you would like to use the asynchronous communications port when your modem is not in use, we will add a connector and the necessary circuitry for just \$20. This saves you the hundred bucks or so you would spend for another async card and saves a valuable slot. It can be configured as COM1 or COM2 and works just like IBM's does.

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appear. For example, Actors is a subcategory of Famous People.

The two players, or teams, then take turns selecting any two boxes, numbered 1 through 30, from the 5-by-6 grid. Behind each box is a name, a word, or a "wild card" symbol, which has a match elsewhere on the grid. If a player selects two boxes that do not match, the turn passes to the other player. If there is a match, that player receives 150 points, and the program reveals whatever parts of the rebus puzzle are hidden behind those two locations. The object, of course, is to be the first to figure out what common saying or famous name the puzzle illustrates.

Strategic Tension

A player who makes a match is given 30 seconds to type in the solution to the puzzle. He may pass by hitting Enter, in

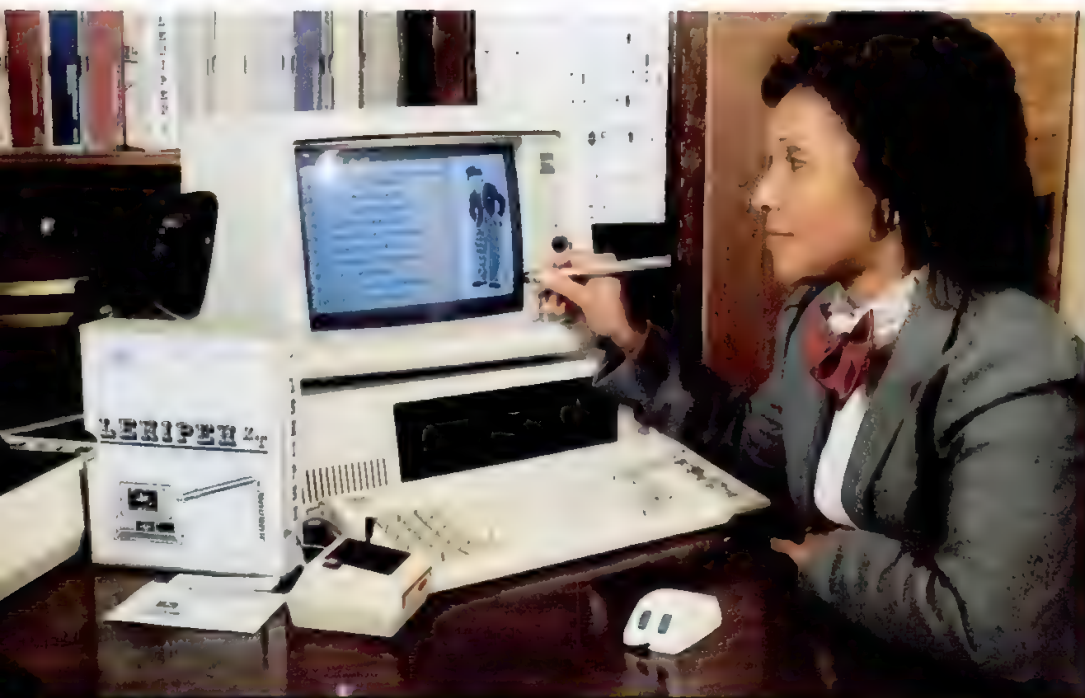
which case it would be his turn again to select a pair of boxes. If he fails to answer or does so incorrectly, the opponent is given a chance to win the round. Remember: anything you see on the screen is public information—a design element that helped "Concentration" gain popularity. It produces a good deal of strategic tension. "Should I bide my time or go for it?" is the question here.

A significant complaint about *Match Wits* is that the players have only 30 seconds to type in the rebus solution and hit Enter before the computer reads no input and allows the other player to take a turn. Let's assume, for example, that after about 15 seconds you figure out the rebus must stand for "The Midnight Ride of Paul Revere." What should you do? If you pass, you might give your opponent a chance to win the round on the next turn.

And if you try to quickly type in the answer but run out of time, you've given the solution to the opponent.

Match Wits displays an option to quit the game or change players at the end of each session, which makes it easy to play round-robin tournaments. The winner is allowed to play the same opponent again, take on a new opponent, or retire and make way for two new players.

At first I was quite skeptical about the replay value of *Match Wits*. I thought once I knew all the puzzles and rebuses that there would be no more reason to play. There is some truth to this complaint, but the puzzles are constructed to minimize this problem. The 15 pairs of matching items that go into any single puzzle are drawn at random by the computer from a file of 30 pairs in that particular category. Also, the same rebus concealed behind



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two different puzzles gets uncovered in a different manner, which helps further mask the others.

Let's assume, however, that despite these masks, you are familiar with the facts pertaining to Cities, or that the vocabulary given in the Words section is beyond your level. No problem, you can alter the preprogrammed files or create your own from scratch. To do so, select the Secretary program from the main Game Menu, which will allow you to create an entire game. You must create three files, one for each round or set. Each file must have enough space to contain up to 30 matching pairs if you want to take advantage of the computer's ability to randomly create different puzzles from the same category file. The Secretary program also prompts you to create and save a new Game Menu whenever a new file is created so that it may be accessed for play.

There is no need for a blank formatted disk, because the game disk stores up to 16 completed subject categories of three game files each.

The most significant achievement of *Match Wits* is that everything about the matching pairs and subject matter can be controlled and fine-tuned to interest anyone from age three to ninety-three, which makes *Match Wits* a good educational tool. You can create games about mythology, history, children's literature, languages—the possibilities are endless.

It would have been nice to have, say, 100 different rebuses stored on the disk, even if this meant having to store my own game files on a blank disk. A rebus generator would have made *Match Wits* a nearly perfectly designed game.

But until something better comes along, I'll be putting *Match Wits* to good recreational use.

On PC's game rating scale of one to six, *Match Wits* rates:

FUN:	5.0
CHALLENGE:	4.5
GRAPHICS/SOUND:	4.0
TOTAL:	13.5



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Lost In The PC Jungle

Ashton-Tate has published a reference manual to guide novices and experienced users through the undergrowth of computer terminology. Unfortunately, this guide has lost its way.

With the abundance of software directories and PC manuals on the bookshelves today, Ashton-Tate's recent announcement of a reference encyclopedia was welcome news. The two-volume *Reference Encyclopedia for the IBM Personal Computer* promised to clarify the details of programming while "review(ing) IBM and non-IBM programs and add-ons realistically, so you don't get trapped in the software/hardware jungle." Ashton-Tate advertises that the book will expand our knowledge of IBM PCs and tell us "what IBM won't." When it comes to manuals, Ashton-Tate points out, "IBM makes terrific computers." Unfortunately, when it comes to manuals, Ashton-Tate makes terrific software.

Consider, for example, the way the encyclopedia handles command listings. The first entry in the encyclopedia is: "A—Append Lines. Command in EDLIN." The four-paragraph definition that

follows consists of a two-paragraph description of EDLIN followed by two paragraphs about the A(ppend) command, which I quote in part: "... you may append lines from the original file by using the A command. A appends lines into memory from the original file being edited. This is used only with files too long to fit into memory."

The first two sentences of this statement need to be run through a merge command. If the file is already too long to fit into memory, how can more lines be appended to it? The definition is, at best, vague when it states: "A(ppend) is ordinarily used after W(rite) has freed up some memory. . . ." In contrast to Ashton-Tate's ambiguous comments, the IBM DOS manual clearly states: "To edit the remainder of the file that will not fit into memory, you must write edited lines in memory to diskette before you can load unedited lines from diskette into memory by using the Append Lines command."

The A—Append Lines definition concludes with the cross-reference "See EDLIN." The EDLIN section of the manual is a five-and-a-half-page explanation, which I quickly scanned for remarks on A—Append. I finally found a reference to the A(ppend) command on the very last page, right after the definition W (Write) and before E (End Edit). Having found it, I discovered that it copies the earlier defi-

nition almost word for word.

Since this clearly was not satisfactory, I began reading from the beginning of the section. A page-and-a-half in, I hit pay dirt. Referring to a diskette file, the encyclopedia states: "In case only part was loaded (and only in this case) the A and W command may be used. You can use the W(rite) command to write some of the edited lines to diskette. Then use the A(ppend) command to load more lines of your file into memory." In other words, before you use Append, you must make room in memory by using the W(rite) command. In this instance, the DOS manual was clearer and more concise.

Throughout the two volumes, there are many entries followed by an asterisk. These denote descriptions of a variety of IBM-compatible hardware and software. For example, "Anaconda" was annotated in this manner to indicate PC compatibility. The definition itself read, "Anaconda*—Similar to the old Blockade game, this program has several new and interesting twists." Like the A—Append definition, this one revealed little to me. Attempts to cross-reference were equally unsuccessful as "Blockade" is not even listed in the encyclopedia.

The next definition, "Analog—It has a continuous range of voltage or current values. Contrast with: digital," is also vague and confusing. Any dictionary can pro-

Reference Encyclopedia for the IBM Personal Computer

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vide a better definition of the cross-referenced term, digital. The one in Ashton-Tate's encyclopedia offers little clarification of the term: "Digital—Having Discrete States. Digital logic may have from 2 to 16 states. Most logic is binary logic, with 2 states—on or off."

Returning to the listing for Analog, I came across an additional entry, "Analog RGB Monitors*." This was defined as a "monitor featur(ing) RS-343 analog input, in-line gun, . . . Control Systems." Checking for cross-references, I discovered that the only listing under RGB is "RGB Cable for Sony Profeel*—This is a cable for interfacing IBM PC to Sony Profeel. Strict & Associates." There are no listings for RS-343, Sony, and/or Profeel. The listing for Monitor begins, "The software which is in the PC with a program to be tested, which may determine your ability to detect and interpret errors."

Dead End Checks

All of my attempts to check possible cross-references to obtain useful information were futile.

An examination of the definition of "Array" revealed a similar problem. "Arrays—BASIC. See DIM (variable)(subscripts) and OPTION BASE (n)." There are no listings for anything beginning with DIM or dim. As for OPTION BASE, the encyclopedia said that it "declares the minimum value for subscripts in an array." Unfortunately, subscript is also unlisted. Clearly the entries need to be more fully defined and additional entries inserted for cross-referencing if this is to be the compendium of computer references Ashton-Tate advertises it as.

In addition to definitions, Ashton-Tate also includes software listings and reviews of the same. An example is the entry, "dBASE II*—A powerful software package driven by an English-like programming language."

This brief description is followed by more than 13 pages outlining this Ashton-

Tate software package. As for some of dBASE II's competition (*KnowledgeMan*, *MDBS III*, *Revelation*, *PC-File*), there are no listings provided. So much for objective reporting.

For those interested in spreadsheets, entries on *SuperCalc* and *VisiCalc* can be

A ten-page table of the BASIC vocabulary contains clear and concise descriptions.

found easily. The entries were approximately two pages each. It was a little more difficult to locate the entry for 1-2-3. After some searching I found it listed under Lotus 1-2-3. It was detailed in just over one page. These explanations are most useful and provide a concise overview of each package, though none are as thorough as the dBASE II entry.

To quickly review the encyclopedia's treatment of hardware, I decided to look up "mouse." Someone had just asked me what a mouse does, and I had been wondering myself how they work.

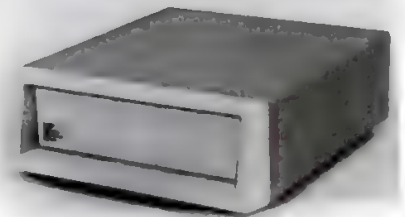
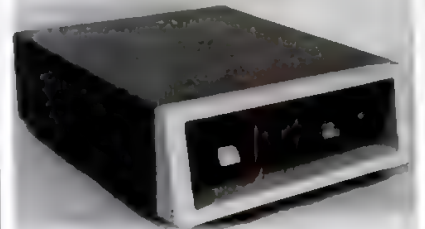
As it turned out, "Mouse" isn't listed in the encyclopedia. However, "Mouse Controller" is listed. Under that heading, I read that it is "a simple way to move the cursor anywhere on the screen by moving a 'mouse' on any surface. Tecmar, Inc." Since this statement left much unsaid, I decided to try my luck by searching for a definition of light pens. This I found, and it read: "Light Pens—See FT-156. A practical alternative to a keyboard for interaction with a computer, the Light Pen is operated by touching the push-activated device to the screen, and the computer takes appropriate action. . . . The Light Pen is useful in educational areas . . . Games are fun, and demonstrations are striking with a Light Pen. FTG Data Systems." Although this is a considerably better definition than that of "Mouse Con-

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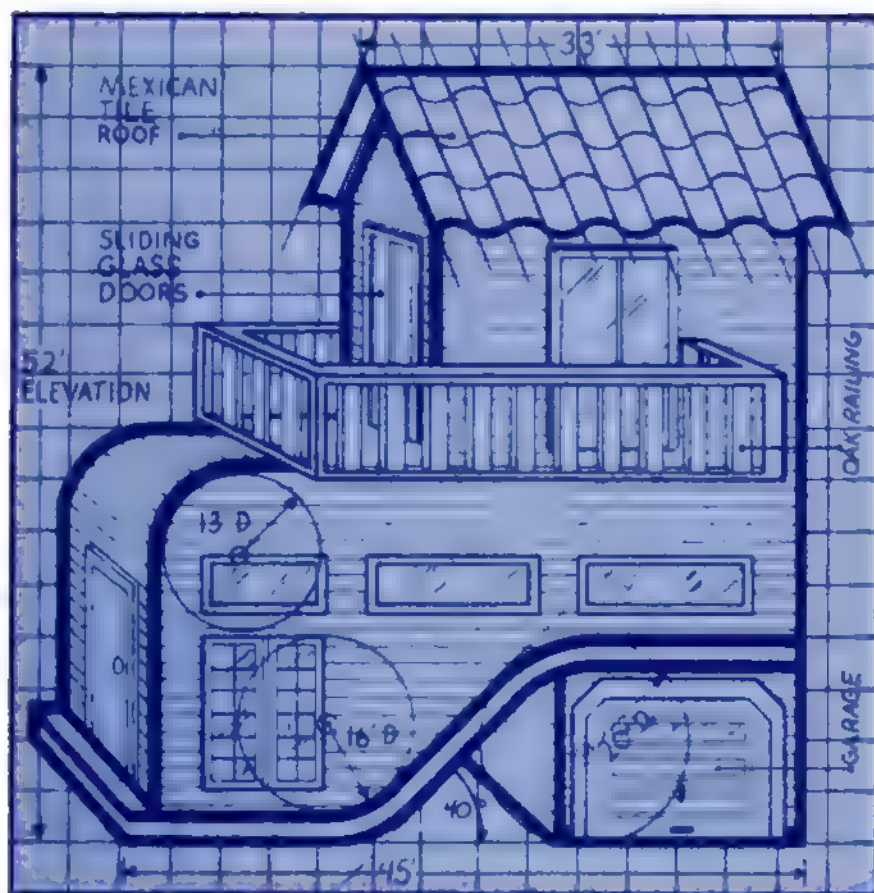
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troller," a little something about what light pens are and how they work should also have been included.

Math Problems

The math listings are similarly vague. The definition of HEX, for example, reads: "HEX is the extension for a file that contains Hexadecimal data in ASCII rep-

A five-page essay on batch processing makes the same topic easier to understand in the DOS manual.

resentation." It adds that the "HEXS function returns the string representation of the hexadecimal equivalent of the decimal argument." While accurate, this is hardly a complete definition.

The listing for "Binary" fares only slightly better. A binary number is a "representation of an integer as a sum of powers of two, using a sequence of zeroes and ones." True enough, but what about non-integers? Don't they somehow or other find their way into some sort of binary format? There's no comment in the encyclopedia.

Despite these shortcomings, there are some very helpful entries in Ashton-Tate's encyclopedia. There's a nice section called "BASIC-Statements Cross-referenced by Function." For example, if you've forgotten how to erase a BASIC file, look it up here, under "Erase," and you'll be referred to the truculent-sounding but useful command KILL.

There's also a handy ten-page table of the BASIC vocabulary, which feature clear and concise descriptions. These are tabulated under columns labelled Statement, Type, Description, and Versions (that is, Cassette, Disk, Advanced, and Compiled). Every word, including the

BOOK REVIEW

commands and functions, appear in alphabetical order under the Statement column, and the Type column indicates S, C, or F, as appropriate. As in the IBM BASIC manual, asterisks indicate which BASIC version(s) apply. However, a plus sign in the Compiled column clearly indicates to you that the statement functions differently.

There's a brief summary of BASIC 2.0, which objectively highlights the significant changes over earlier versions. And the BASIC Compiler entry presents a

To its credit—and like other Ashton-Tate products—the encyclopedia is sturdily packaged.

good one-page overview of compiled and interpreted BASIC.

Batch processing is treated to a five-page essay that will make the same topic easier to understand in the DOS manual. And the CHKDSK entry gives a little more information than is found under the same heading in the DOS manual. Still later, there's a section called DOS Messages, which contains a complete alphabetical listing of all DOS messages. There is also a seven-page overview and comparison of DOS 2.0 and DOS 1.1, followed by a good review of the DOS editing keys.

A Mixed Bag

At \$69.95, Ashton-Tate's *Reference Encyclopedia for the IBM Personal Computer* is almost, but only almost, worth the price. To its credit—and like other Ashton-Tate products—the encyclopedia is elegantly and sturdily packaged. The type styles are well-chosen and typos have been kept to a minimum. Lettered tabs are printed on heavy stock, which is rein-

forced near the three-ring holes. The two binders and the pages within are slightly larger than the IBM series of manuals, with the slip case standing about an inch taller than Big Blue's.

As noted, the entries are a mixed bag of good, bad, and indifferent. Nevertheless, if you can manage to overlook the extraneous, here and there you may find a page or two of useful information. ■

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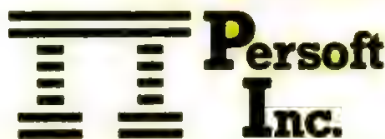
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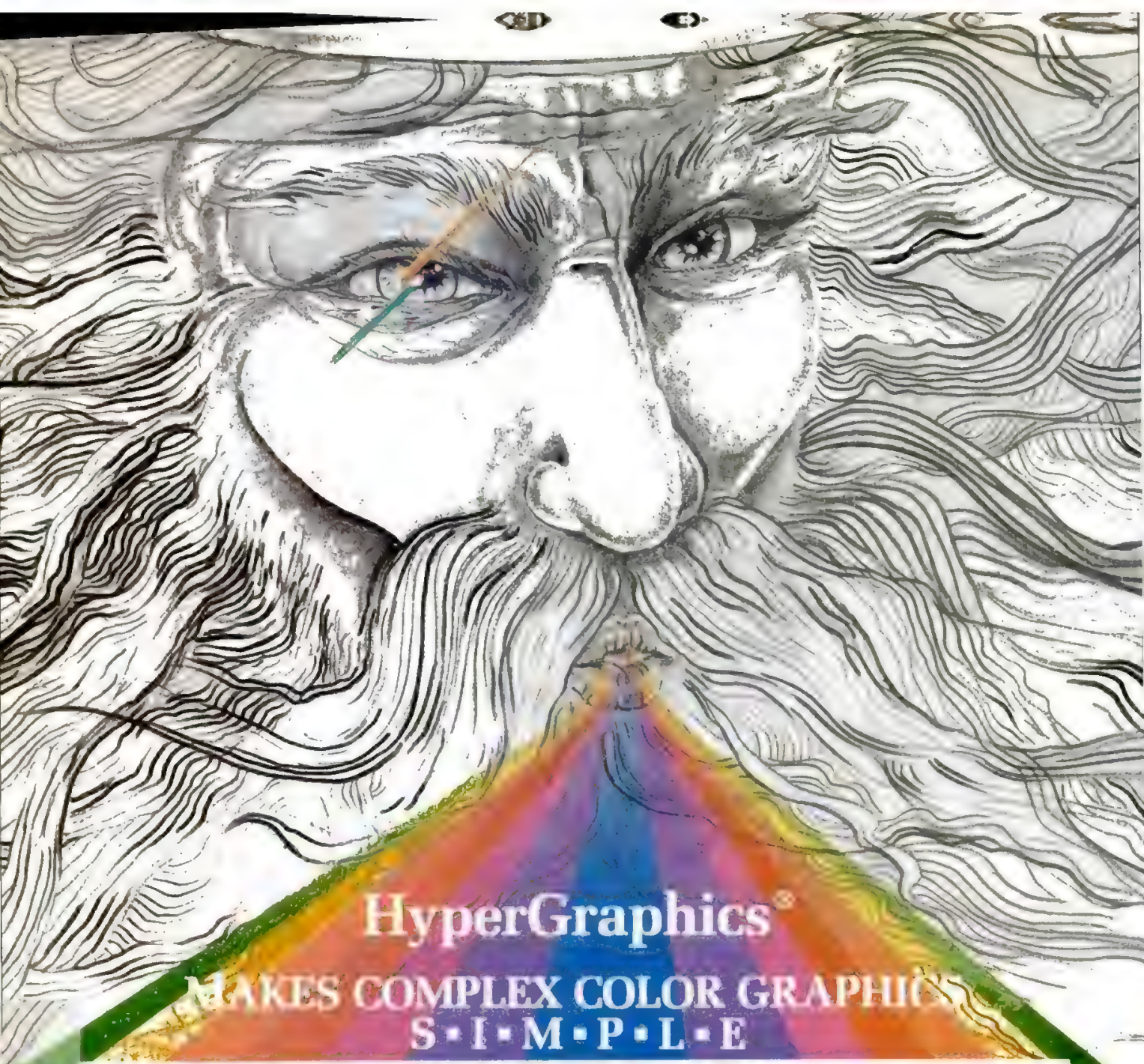
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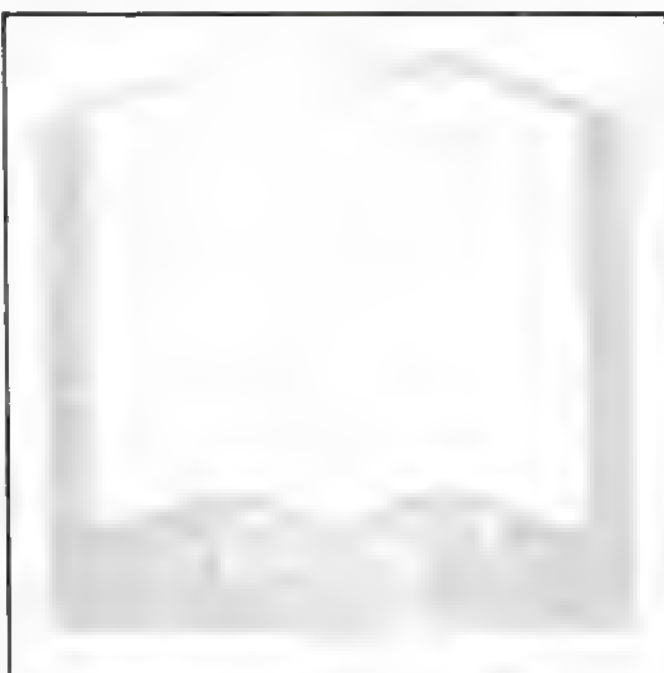
For professional writers, word processing can open opportunities and eliminate wasted time as it teaches new skills and encourages new work habits.

In the dark ages before word processors were in wide use (2 years ago), as a professional writer I relied on a limited range of supplies. I used three types of stationery: letterhead, good-quality white bond, and some cheap yellow junk (used in editorial offices throughout the world) called railroad manilla. Other supplies gobbled up by my aging but nonetheless trusty IBM Model D typewriter included white correction tape, correction fluid, ribbons, and carbon paper.

In the almost 2 years since I bought my IBM PC, I've had to buy new supplies to support my word processor's habit: ribbons for my two printers (an NEC formed-character printer and a C. Itoh dot-matrix); one-part teletype paper; two-part teletype paper; one-part blank pinfeed paper; self-sticking labels (often called "peel and stick"); three print thimbles for my formed-character printer; assorted printer cables; a holder for the teletype paper; disks; and platen cleaner, for when I try to print without paper in either printer.

It's not always easy to find these supplies, and they're not always cheap. I waited 6 weeks to receive the C. Itoh ribbons (they were back-ordered from the distributor because of heavy demand), and my NEC printer seems to have developed a gourmand's appetite for \$12 to \$14 ribbons.

The cost and difficulty of obtaining



supplies is a common inconvenience for anyone working on a word processor. But for me, the advantages of working on a word processor have been more significant than these drawbacks.

The Easy Life

I bought my IBM PC with the IBM word processing package *EasyWriter 1.0* in March of 1982. At that time, *EasyWriter* was one of the few word processing packages available, and I figured that I'd be safest going with a product from Big Blue. *EasyWriter 1.0* received a lot of bad press and was widely regarded as a weird product. One reviewer said *EasyWriter 1.0* "acted like it was on drugs." But although it did sometimes seem slow and cumbersome (files could not be transferred from the *EasyWriter* format to the

DOS format, for instance). I used it for several months with no significant problems.

Then IBM offered a free upgrade, *EasyWriter 1.1*, which corrected many of the problems of the earlier version and made it possible to transfer files to the standard DOS format so they could be read by other software. I've used *EasyWriter 1.1* for about 8 months now, and it suits me fine. It was easy to learn, and I've found only two or three things it can't do gracefully. And if you're clever, work-arounds can compensate for many of the word processor's remaining limitations. (*EasyWriter 1.1*, for example, does not support wild-card searches. Say you wanted to search for all occurrences in your text of the words *affect* and *effect*. In a wild-card search, entering ?FECT would produce a hit on either word. With *EasyWriter 1.1*, a good work-around would be to conduct a search-and-replace operation by entering FFECT and then replacing selectively. It's not elegant, but it works.)

Editing is one area in which word processing has changed my life for the better. The first draft of anything coming out of a typewriter—a letter or article for example,—is usually littered with strikeouts, deletions, and inserts. Editing a draft that's full of chicken tracks, arrows, and inserts can be distracting. Obviously,

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WRITING

word processors avoid all that—you just backspace and rewrite. But although first-draft outputs from word processors look clean, I still tend to go back to the keyboard to play with the words and tweak a

Paradoxically,
because word
processing with a
computer is so easy,
I began to devote
more time to work,
not less!

word here or move a paragraph around there. I can't imagine continuous tweaking on a typewriter—it would mean too much work retyping the document.

More Time to Work

Flush with all my newly saved time, I decided to take on additional work. I volunteered to write for a PC users group newsletter. Paradoxically, because word processing with a computer is so easy, I began to devote more time to work, not less!

A word processor is particularly useful when writing letters. After I write a letter, I often think of a more effective way to make a point. When I worked at a typewriter, this meant yet another retyping. With a word processor, I write the letter, put it on the disk, and forget about it for a few hours. Invariably, my second pass several hours later produces a much better letter.

Because it's so easy to do letters on a word processor, I find I write more of them. I save time on each letter, but I turn out more. This means keeping track of more letters, more subjects, and more letter recipients.

Some of the time I save with my word processor goes into learning how to make the most of my software and my printers. *EasyWriter* is relatively easy to use—I've

shown other writers how to use it in less than 5 minutes. But *EasyWriter*, has many useful features that can be attempted only after the basics have been mastered.

I found the manual less than helpful in many instances and I spent Lord knows how many hours experimenting. Manuals are often maddeningly opaque until you've been able to decipher them, at which point you no longer need the manual. Catch-22, sort of.

One advanced function I finally got around to learning is manuscript preparation. Journalism standards call for the word *MORE* at the bottom of every manuscript page, and a story slug (identifier) and page number at the top of every page. For a long time, I did these manually. First, on the CRT, I'd count off groups of 27 lines, then eject the page. When I had printed the entire manuscript, I'd go back and re-insert the pages in the printer, positioning them so that the print head was at page bottom, and then print the word *more* in a second pass of each page.

Alternatively, I'd count off groups of 27 lines and insert the word *more* as the 28th line. But, after doing this for a few weeks, I decided that there had to be a better way. I spent a few hours tinkering with the program and finally came up with a way of putting both the word *more* and the page numbering on each page automatically.

Conserving the Mess

Then, there's also what I call the Law of Conservation of Mess. I'm not a neat person: Visitors to my office have been known to shudder and mutter about "cleansing the Augean stables" after seeing where and how I work. There are papers, notes, telephone numbers, newspapers, mail (read and unread), magazines, files, and other detritus everywhere.

This mess, unfortunately, threatens to extend to my disks. I've labelled each disk with the name of one of my clients, and I try to keep material for, say, *PC Magazine*, on that disk exclusively. But some-

WRITING

times I forget. The result is that after a hard week of sweating and slaving over a hot keyboard, I find that files I've worked on are scattered throughout a box of disks. This, in turn, means I try to set aside an hour or so each week to clean up my files.

Manuals are often maddeningly opaque until you've been able to decipher them, at which point you no longer need the manual.

I'm not always as successful as I'd like to be—an inventory I took in preparing this article showed 196 files scattered over 15 disks. (Not to mention the 59 files on the two disks labelled "ARCHIVES.") Still, good disk discipline is easier than the seemingly incessant filing I used to do, and it probably takes far less time.

International Word Processing

I also write for a British newspaper, and to make it easier for my British editors and copy editors to process my copy, I try to stick to British spellings—endeavour, flavour, organise, for example. Sometimes, in the rush of getting stories ready, I forget to put on my bowler, and I use American spellings. In those cases, I simply search for all occurrences of "ize" and replace them (when appropriate) with "ise" for instance.

But I've saved the best part of using a word processor for last. A word processor can help you make a few bucks writing articles like this one!

Howard A. Karten is a systems programmer turned free-lance writer, who lives and works in the Boston area.

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The Dental Office Management System is an accounting and patient management system designed especially for dentists. It can be custom-tailored to meet specific needs.

When a dentist hears the term *high tech* used in relation to his profession, he probably thinks of supersonic drills and optical-scan X-ray machines. But *high tech* describes not only the equipment a dentist uses, but also the methods a modern dentist might use to keep track of appointments, pharmaceutical inventory, patient files, and accounts.

These high-tech tools often include software written for the IBM Personal Computer. One such program is the *Dental Office Management System*, more commonly referred to as the *MS80*, from MICRO/SYS80, in Southampton, Pennsylvania. *MS80* is easy to implement and provides a relatively inexpensive (and therefore painless) way to computerize a dental office's accounts receivable, monthly billings, insurance claims procedures, word processing, and recordkeeping. As a practicing dentist at The McPhillips Dental Health Centre, in Winnipeg, Manitoba, I

Dental Office Management System (MS80)

MICRO/SYS80

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Price: U.S., \$2,400; Canada, \$3,800.

Requires: MS-DOS, 128K RAM, hard disk, one disk drive, printer.

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started using *MS80* 2 years ago.

Before the clinic made the purchase, MICRO/SYS80 provided us with a complete demonstration system, which enabled us to create a mock office situation. The demonstration helped us to choose a specific software package, because we were able to actually observe the program in operation and determine whether it was feasible for our office.

We needed a software package that could accommodate between 10,000 and 12,000 patients, three dentists, three hygienists, several hundred procedural codes and fees, and approximately 10,000 transactions a month. *MS80* handles up to 100 insurance companies, up to 100 dentists/hygienists, and up to about 10,000 patients (or more, depending on which hard disk is used). The history files and

transaction records are also regulated accordingly. *MS80* was made for us.

But letting go of old ways and starting fresh is always difficult. Once we decided on this system, we had to start the transition. For about 60 days, we ran the new, computerized system and our old manual system in parallel. This allowed the staff to relax and familiarize themselves with the new system.

The system operates on the IBM PC-XT computer under the MS-DOS 2.0. It requires a hard disk and a good-quality high-speed printer. The end-user program was written in COBOL by Ryan-McFarland. The COBOL program is delivered to the dental office as a machine-language program on two 5-1/4-inch floppy disks. Since the program is written in machine language, the speed of execution is ten to 30 times faster than similar programs in interpreted BASIC.

Every dentist in the clinic is assigned his own file for the maintenance of identification numbers, addresses, telephone numbers, social security/insurance numbers, and other information. These files are used for third-party insurance-claim forms.

Patient files include addresses, telephone numbers, and accounting information necessary for the completion of monthly statements, records, analysis, and third-party insurance forms. The

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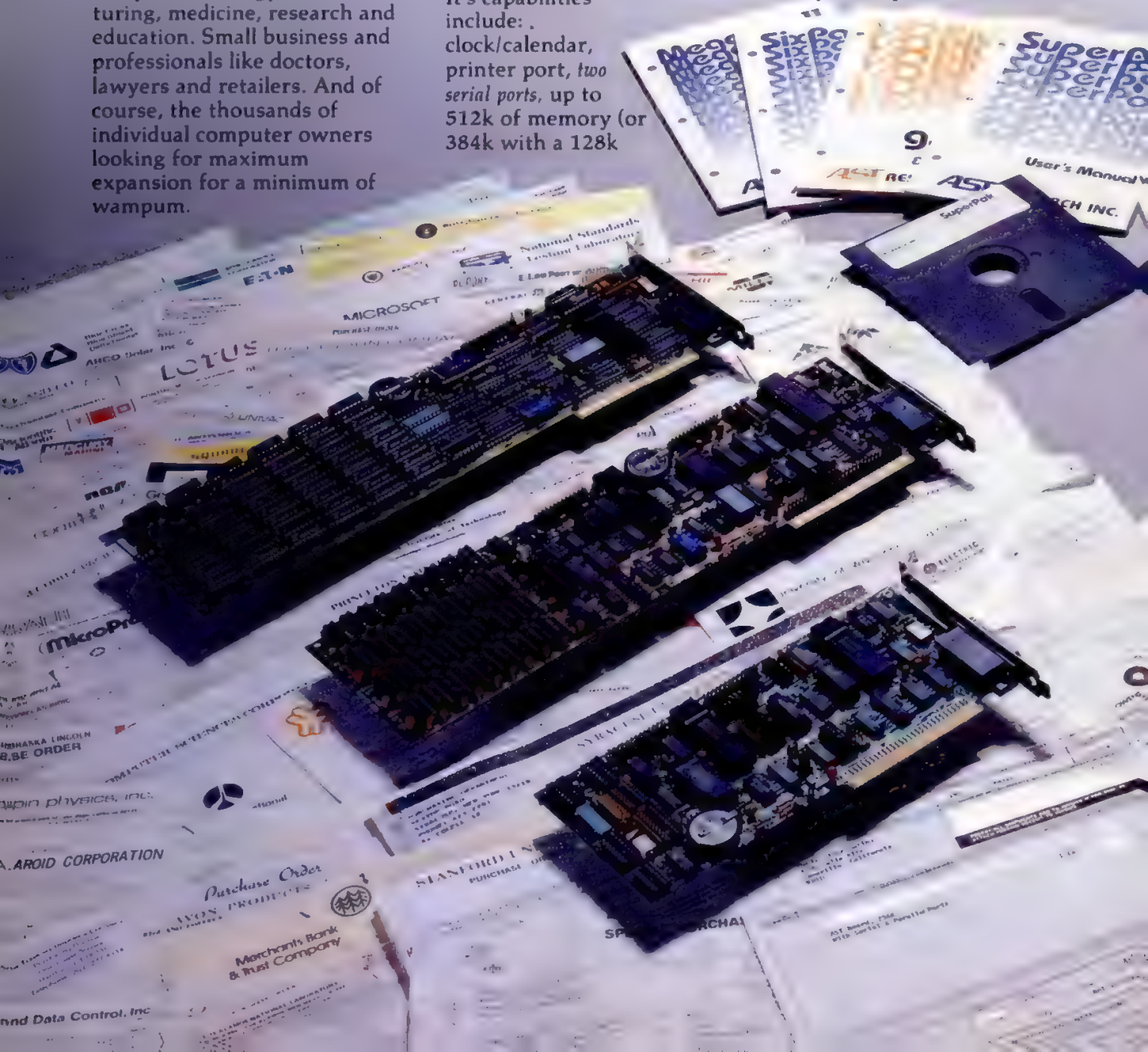
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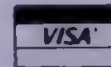
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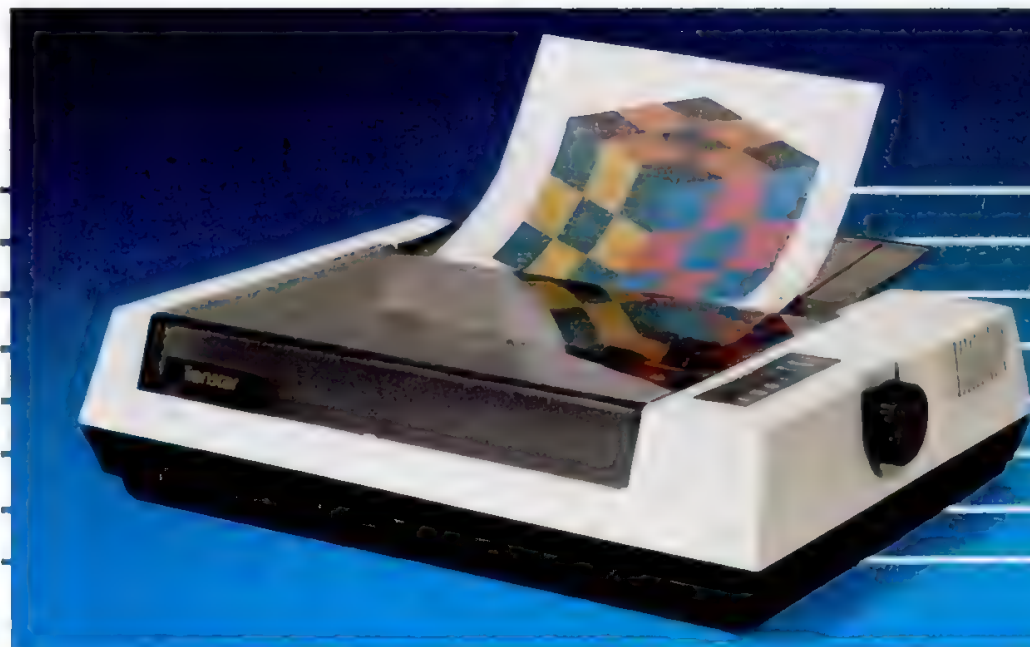
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accounting and patient data are presented to the receptionist as easy-to-read, form-type ledger cards.

Since implementing the *Dental Office Management System*, we have greatly enhanced our efficiency. Staff is kept to a minimum, and tedious tasks are eliminated. The system locates patients by their names, account names or numbers, or partial entry of names. You can access the name, Smith, for example, by entering the letters SM or SMI. Since the charges, payments, appointments, and recalls for each patient are so simple to enter, even nonexperienced staff members can quickly and easily learn to enter data.

The manual we received with the system is spectacular. It is a tutorial-type, walk-through guide for the computer-illiterate dentist and his staff. We knew next to nothing about computer data processing at first, but now we are all comfortable with the system.

Production and collection transactions, along with recalls and appointments, can all be recorded during a single processing procedure. Insurance forms can also be generated along with receipts. One entry updates accounts receivables, production analysis, collection analysis, and insurance receivables. At the same time, account aging is accomplished, statements are created and stored for retrieval, and many other valuable reports are stored for the dentist's use. This means we can keep our insurance company receivables to under 30 days and keep on top of patient accounts that are outstanding.

MS80 accommodates the needs of dentists in both Canada and the United States. It produces both American Dental Association and Canadian Dental Association third-party insurance claim forms.

Information in any file can be added to, changed, deleted, displayed, or sent to the printer for hard copy at any time. By having these facilities at our fingertips, we can easily correct mistakes. Our files are protected by creating daily backup files, which are stored off the premises.

This system generates a recap of all dai-

ly activities in report format. By producing this type of report each day, we enhance our diskette backups with a hard copy backup. The report is broken down by patient and then separates them according to their dentist and type of payment. The daily function also incorporates patient charge slips for the next day's appointments and produces the next day's appointment list. It used to require an hour at the end of every day to accomplish this task manually. The computer does it in 5 minutes. In addition to cross-checking the procedures, the breakdown of payments

It required an hour
at the end of every
day to accomplish
my task manually.
The computer does
it in 5 minutes.

by type and amount makes banking much simpler.

We can generate monthly billing reports, receivable reports, production reports, and collection reports for each producer in the office and for the office as a whole. We also have the ability to produce a practice profile that enables us to see the pros and cons of each individual dentist's style of practice. Monthly account statements are easily created. What once took our office weeks of hard work and endless pulling of ledger cards, now takes 45 minutes.

The Purging of History

Every month the system is put through a cleanup process called "the purge function." This eliminates all current transactions for the present month and lumps the total balances into a sum called "previous balance." This function then correctly ages and updates all the accounts and insurance company data. Purging these functions is required so statements

do not become running reports for an entire year's transactions.

Patients' histories are retained during the purging by placing those transactions into a history file to be stored for a designated time period, depending on how long the dentist wishes to save this information for reference and the capacity of the hard disk. We store our history records for 13 months. We then have the ability to print out a hard copy of a patient's collection history for any part of the year.

It's now been almost 2 years since we abandoned our manual procedure. We are happy with the results and optimistic about the future. The system is very well supported. We now belong to an end-user group in the United States as well as one in Canada, and we receive a useful communications and fact-finding newsletter from MICRO/SYS80 every month or so. The system's programmers are always looking for ways to upgrade and improve the system. Most upgrades and enhancements have been made at little or no additional charge to us. Most requests were accommodated quickly, and they were bug-free. All support needs have been handled by telephone or via the mail, which, so far, has been satisfactory.

We looked at many systems before we settled on the MS80. The cost of implementation was extremely reasonable, in terms of both hardware and software. The package currently costs \$2,400 in the United States and \$3,800 Canadian. (The price is higher in Canada, because the program had to be customized to match the insurance forms.) Maintenance costs are minimal, and breakdowns have been few and far between. More than 50 progressive dental offices in the United States and Canada have already used the *Dental Office Management System* to move painlessly into the world of computerized office management. ■

Dr. Donald Gutkin is currently working at The McPhillips Dental Health Centre, in Winnipeg, Manitoba, Canada, where he uses the MS80 system.

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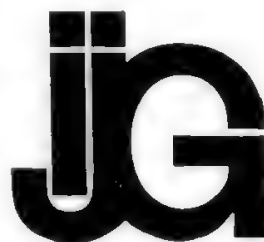
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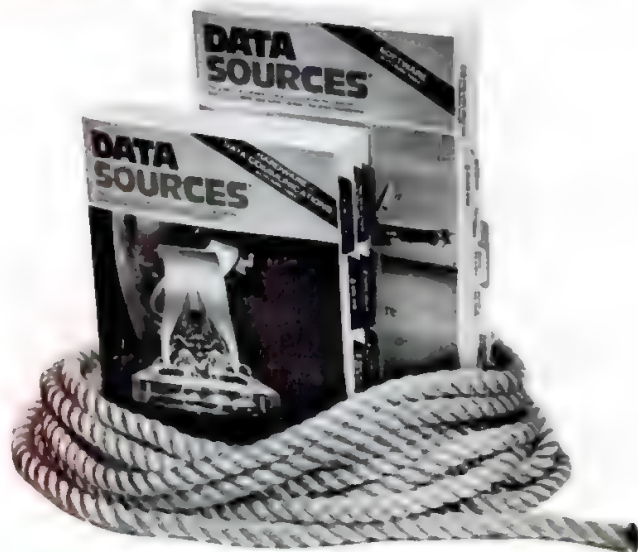
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Starting On The Right Foot

Lawyers who are ready to computerize their offices need to look before they leap. Before buying a microcomputer, the first matter to decide is the kind of work it should do for you.

One of the obstacles keeping lawyers from joining the microcomputer age is the limited amount of information available to help them decide whether they need micros at all. Most lawyers therefore start the educational process at the wrong level.

A common wrong-level remark heard is, "I think I'll take a course in data processing." Or worse, "I need to know more about computers. I think I'll take a course in programming." Or, "I think I'll go to the local computer store and see what they have." None of these approaches addresses the fundamental question: "How can the computer help me in my law office?" Here are some of the key points lawyers need to consider.

Remember this rule: Anything a computer can do, you can do by hand. The computer just does it faster and, in most cases, more efficiently.

Every law firm is different, and each has different uses for a computer. But all law office applications fall within these general categories: word processing, information management, number crunching, electronic spreadsheets, communications, and miscellaneous.

The Almighty Word

Words are a lawyer's primary tools, and word processing is the most useful application for many law firms. It requires



a word processing software package, of which there are more than 100 ranging in price from less than \$100 to more than \$500. Since an entry-level computer, printer, and word processing software package can be purchased for between \$3,000 and \$5,000, this is an inexpensive introduction to computers for a lawyer. Many small firms justify the purchase of a computer by using it first as a word processor. Later they learn how powerful the computer is, and its other applications become a dividend. If your office already has a dedicated word processor, then the computer can be a backup or can be used for special word processing applications.

With word processing in place, the next step might be to set up an information management system. The object of information management is to keyboard (type)

the basic information just once, then use a database management software package to sort and select specific information.

You can also sort and select by culling out the names of all client matters handled by each lawyer, or sort and select by lawyer and court to determine the cases in each court by each lawyer. This same application can apply to a calendar control system and time and billing system. The sort and select process is limited only by your needs.

Playing The Numbers

In law offices with many procedures involving entries that require addition, subtraction, multiplication, and division, number crunching is an invaluable application. It lends itself particularly well to bookkeeping and payroll.

A general ledger (bookkeeping) program allows you to assign accounting code numbers to expenses, income, and other bookkeeping entries. This will normally be done with the assistance of your accountant. You then keyboard the date, amount, payee, and accounting code number of each check, as well as the date, amount, and designation of each deposit. The computer automatically produces a printed list of all posted items, a ledger account according to account number of each posted item, a trial balance, a statement of income and expense with monthly



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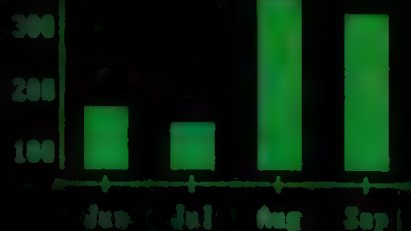
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totals and year-to-date totals together with percentages, and a balance sheet for the month with year-to-date totals and percentages. In the past, I could never afford the time to prepare monthly statements. Now my monthly statements are prepared by the computer in less than an hour, and I can immediately have a year-end statement as soon as the bank account is received for the twelfth month.

Other examples of number crunching involve income tax projection or estate tax projection programs. These packages allow you to perform calculations that might otherwise be impossible because of the time they take. I use an estate tax program to make projections for my clients. If I had to perform the calculations by hand, it would take 5 to 6 hours. The computer makes the calculations and prints a report in 15 minutes.

Better yet, there are income-tax programs available that perform "what if" projections. If you have entered all the income and deductions for a client, the computer instantly calculates income averaging, alternate minimum tax, and net tax liability. Once these numbers have been entered into the computer, you can change an item of income or expense, and the computer will calculate instantly the changed amount of alternative minimum tax and net tax liability.

Among the most popular types of software available for personal computers is the electronic spreadsheet. Visualize a sheet of paper divided into vertical columns and horizontal rows. Most spreadsheet packages have more rows and columns than you will ever need (one offers 63 columns and 254 rows). These spreadsheets allow you to enter information and mathematic formulas; when you change the numbers within the columns, each mathematic formula will electronically produce new calculations based on the change.

Electronic spreadsheets are especially useful when you are trying to make financial projections for a client and want to make some "what if" calculations on the

effect of various changes on the financial projections.

A Wealth of Information

Most law firms have extensive libraries, but a computer can put lawyers in touch with vast wells of information. There are now hundreds of on-line databases (not to be confused with database management systems) available to any lawyer who has a computer and a modem. (A modem allows your computer to communicate with another computer over regular telephone lines.) Databases probably already familiar to lawyers are Westlaw and Lexis. In addition, lawyers can access many other databases on numerous subjects. Most database services charge based on on-line time. Some have minimum charges; some have monthly service charges.

The computer and modem can also transmit documents you produce from one office to another. If you have a branch office and both the branch and the main office have a computer and modem, you can prepare a document in one office on your word processing equipment and send it electronically over the telephone lines to the other office. Indeed, you can send a document to anyone who has a computer and a modem. It is quite likely that lawyers will electronically transmit pleadings and briefs to court at some point in the future.

Numerous companies operate electronic bulletin boards that allow lawyers, through their computers and modems, to post notices for other lawyers around the country to read. Interested readers can then contact the posting lawyer, either via computer and modem or by telephone.

There are other applications useful in a law office that don't conveniently fit into any of the previous categories. Extremely helpful is software that automatically produces income tax returns. Other software allows you to retrieve documents and information using a key word search technique similar to Westlaw and Lexis, reconcile your phone bill, or fill out immigra-

tion and naturalization forms.

Once you know what computers can do for lawyers in the abstract, it's up to you to analyze your own office and determine whether a computer will really help you. You might start by addressing this question: Will it be cost effective?

In my own practice, I resisted the computer because the initial cost was more than I was willing to pay. It was not until I reduced it to a financed monthly payment that I realized I could not afford to be without it. Here's a financial analysis: You can acquire an entry level system for between \$3,000 and \$5,000; \$5,000 financed at 14 percent over 36 months results in a monthly payment of \$170.89. Taking this calculation one step further, if the computer is properly used in your office, it could be busy 40 hours a week, which is about 172 hours per month. If you divide the monthly payment by 172, the computer will cost you 99 cents per hour.

To be hard-nosed about your analysis ask yourself, "Am I willing to pay 99 cents an hour so that my staff will be able to produce more efficiently?"

Of course, there are factors that this analysis leaves out. For example, a computer may allow you to offer a new service to your clients, and this may result in additional fees. Possible new services are estate tax projections, income tax projections, preparation of income tax returns, and financial projections.

If you have decided that you might be able to use a computer in your law practice, don't dash right out and buy one. You need to know three additional things.

- How much do I need to know about computers and where can I find that information?

- What equipment do I need to buy?

- Who will help me get it up and running and keep it operating smoothly?

I will explore these topics in greater depth in subsequent columns. ■

Robert P. Wilkins is a lawyer and the editor of The Lawyer's PC, a newsletter for lawyers using the IBM PC.

Business Decision.

Let's be honest.

Despite the "personal computer revolution" in today's office, a lot of business decisions get made in some pretty arbitrary ways.

That's because most of the *software* for personal computers isn't up to the job of helping you draw conclusions from the mass of information in your business.

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Instead of using the personal computer as a tool for business decisions.

Not exactly a shining moment in the personal computer revolution.

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Computer Kids At College

Teaching children to use computers is a difficult proposition. Some of the problems could be solved by modifying a program for gifted children that's already in use.

There are two major hurdles to teaching children about computers: education of the teachers and funding for the computers.

Most teachers want to learn about computers and share that knowledge with their students, but their classrooms and schedules are already overloaded. The time they need to learn about computers infringes on other efforts and activities. Rudimentary knowledge of computers is not sufficient; especially since many students may be highly skilled in programming.

The dynamic computer field is changing so fast that even the manufacturers of computer systems have a difficult time keeping track of market conditions. This is evident in the recent problems of Texas Instruments, Timex, and Atari with their home or school computers. It seems unfair, then, to expect classrooms to keep up with the technology.

These are the early days of the microcomputer revolution; indeed, it is only 2½ years since IBM introduced the PC, giving credence to the microcomputer revolution. Compounding the problem of large numbers of teachers who still need computer training is the sad fact that most schools do not have enough computers to train their students adequately. This generally makes it difficult for large schools, with 400 or more students to teach about computers with any thoroughness. Funding is also an



issue. With cuts in government spending, especially at the local level, it's increasingly difficult for school systems to purchase the needed numbers of micros.

Even when parents purchase a computer for their child, formal training at the correct level may be difficult or impossible to obtain. And with college computer faculty leaving academia in droves to accept higher-paying positions in industry, training the teachers becomes even more difficult.

One way to alleviate this confusion is with a modified version of the Gifted Program taught at some colleges (including Chattanooga State Technical Community College in Tennessee, where I teach). In this 12-week program, intellectually gifted children in the vicinity of the college are invited to attend special classes at the

college. College faculty teach classes in computer science, biology, chemistry, physics, and engineering geared to these special students. At some institutions, the program includes ten or more courses. Most of the classes meet for 3 hours on four consecutive Saturday mornings.

At Chattanooga State, the demand for the computer class was huge. To accommodate this response, as well as to allow other children besides gifted ones to participate, the college decided to allow selected faculty members like myself to start independent courses in computers. Most of these courses are taught year round, using the computer facilities of the college. A nominal fee is generally charged and the proceeds split between the faculty member and the college. Not only are the children trained by proficient instructors, but the school also invests the profits in additional computer equipment. And, because of market forces, the courses must be interesting and informative and must meet the needs of participants in order to survive.

A similar approach can be used at area high schools and elementary schools. By pooling computer systems on Saturday, one or more classes might be offered on four consecutive Saturday mornings. A fee of approximately \$20 to \$35 per child can then be charged for the sessions with the proceeds split between the instructor

and the school.

The ultimate challenge for any program involving children and computers is to make it interesting. Sessions must excite as well as inform students. Instead of business or math problems, the students need examples that they can relate to. The ideas incorporated in arcade games can help tempt children into learning.

For example, it is much easier to teach the FOR NEXT statement and the use of the comma with this program:

```
NEW
100 CLS
110 FOR J=1 TO 200
120 PRINT 'TONY',
        Put your name here.
130 NEXT J
RUN
```

than by using a business or math problem. The student can replace the comma with a semicolon to fill the screen with his name.

The teachers of these courses must possess a certain type of imagination to hold the students' interest. A series of exercises for the student must be designed to accomplish the goals of the course. For example, to demonstrate the TAB statement, the teacher could use this program:

```
NEW
100 CLS
110 FOR C=1 TO 30
120 PRINT TAB (C) 'TONY'
        Put your name here.
130 NEXT C
RUN
```

The student can then enter

```
NEW
100 CLS
110 FOR R=1 TO 20
120 PRINT TAB (R) 'TONY'
        Put your name here.
130 PRINT TAB (21-R) 'MARY'
        Put your friend's name here.
140 NEXT R
RUN
```

By changing each PRINT to LPRINT, the

student can print out giant Xs containing his name and that of a friend. The student also learns how to insert paper in a printer, perform line feeds, take the printer off line, and put it on line.

Movement on the screen is easy to grasp if the student can draw a creature and make it move. The program

```
NEW
100 CLS
110 FOR C=1 TO 30
120 LOCATE 1,1
125 REM PUT A SPACE ON EACH
SIDE OF THE ALIEN
130 PRINT TAB (C) '\—/'
140 PRINT TAB (C) '[00]'
150 PRINT TAB (C) '/—\'
155 REM SLOW THE COMPUTER
DOWN
160 SOUND 30000,10
170 NEXT C
RUN
```

teaches how to home the cursor, how to use SOUND to slow the computer down, and how to use a loop to produce multiple images. Since the computer is infinitely patient, it also encourages the student to use his or her imagination to create new and different pictures.

This is the clue to the success of computer training. Computer exercises can be expanded to use all the computer system's resources. For example, the screen becomes alive with noise and action when line 160 of the preceding program is changed to

```
160 SOUND 200,10
161 SOUND 1000,10
```

A quick physics lesson on sound production can easily be taught at this point in the course.

Exploring New Worlds

Students must be encouraged to draw a variety of pictures with the programs. This encourages the students to think independently and experiment with the computer, and it will eventually help them grasp the full meaning of the BASIC and the power

of the computer. Here's a program that illustrates upward movement:

```
NEW
100 CLS
110 LOCATE 24,1
120 PRINT " //"
130 PRINT " || "
140 PRINT " || "
150 PRINT " || "
160 PRINT " ——— "
170 PRINT " VV "
300 FOR R=1 TO 24
310 PRINT
320 SOUND 2000,100
330 NEXT R
RUN
```

It opens up the worlds of outer space travel and science fiction. With encouragement to draw an alien spaceship, the space shuttle, superman, or superwoman, the students learn how to manipulate selected segments of the code to produce the results they want. Inserting

```
294 REM PRESS ANY KEY TO FIRE
ROCKET
295 A$=INKEY$
296 IF A$=" " THEN 295
```

shows how the keyboard can control action on the screen. The idea behind video games unfolds as students learn to use BASIC commands.

The beauty of this technique is that not only are the students learning how to program the computer, debug, and change programs, they also are learning to use deductive reasoning and pure logic to solve a problem. Once they grasp the concepts, the mystique is replaced with understanding of the computer as an important tool to accompany them in their search for knowledge. ■

Tony Fabbri is author of the book Animation, Games, and Sound for the IBM PC. He has taught college for 13 years, including 3 years teaching children in the gifted program at Chattanooga State Technical Community College.



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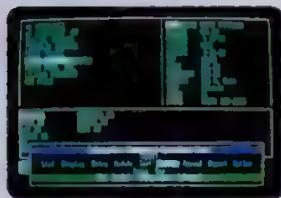
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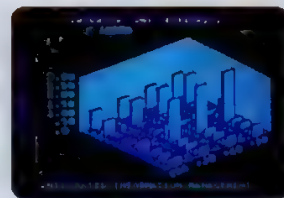
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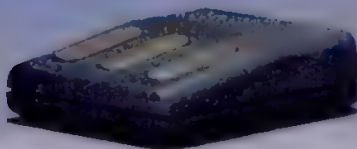
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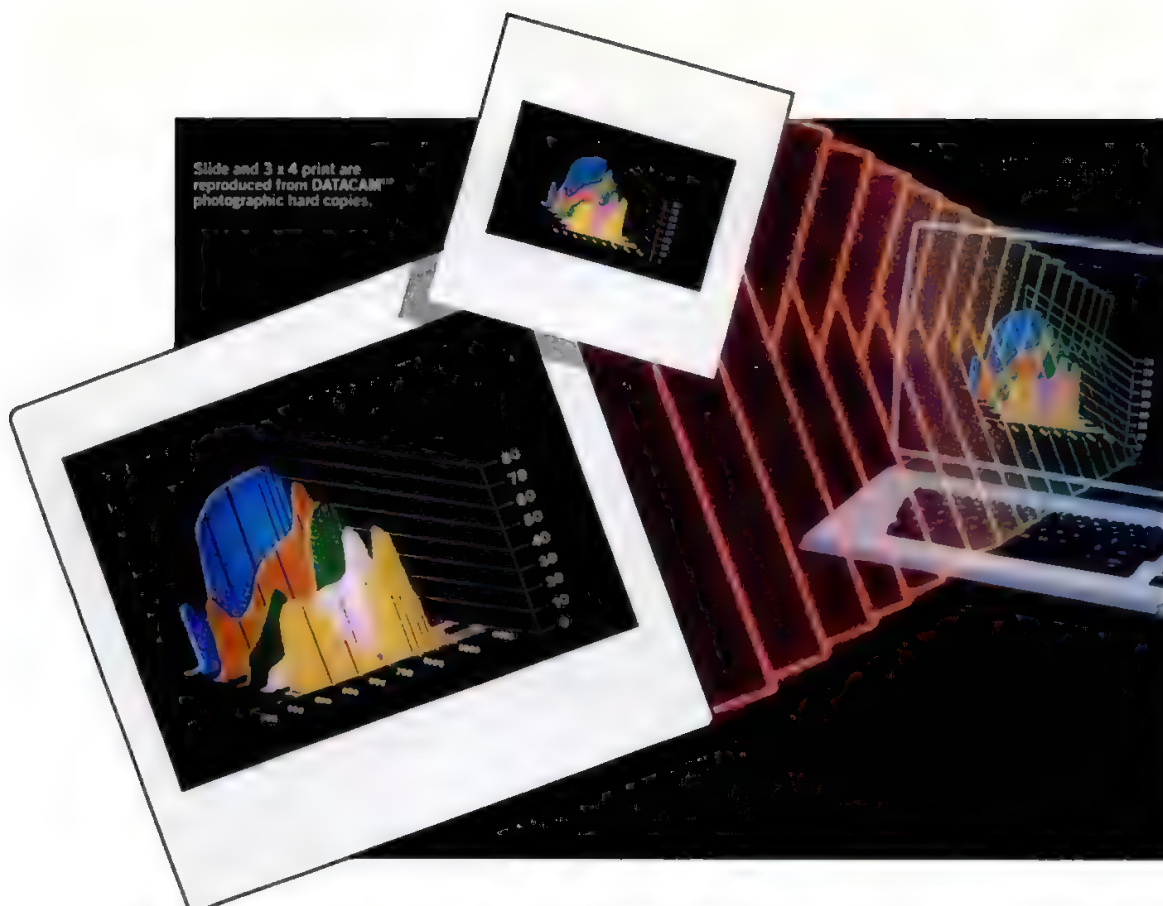


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The New Computer Curators

Database management concerns museums as well as profit-making businesses. But, lacking large amounts of capital, museums must explore alternatives to large in-house systems

After many years of storing information on cumbersome card files, museums are coming out of the dark ages of manual recordkeeping and data storage. Increasingly, institutions known for their love of antiquity are turning to computers to help them maintain their collections.

Take, for example, the Strong Museum in Rochester, New York, which houses a specialized collection of manufactured goods from the nineteenth century, including large numbers of dolls and toys. The museum began to computerize files of its 300,000 specimens in 1975 and, to date, has transferred 50,000 records to a mainframe at the University of Rochester. The museum pays \$3,300 a month to rent an IBM 3350 disk that stores 66 megabytes of information. Recently, the museum installed three IBM PCs and two XTs to unbundle word processing from the mainframe and to perform office work.

The Strong Museum spent \$140,000 on computerization between 1978 and 1982. Its staff's commitment to the computer age is equally strong: 45 of the 100 staff members have signed up (at the museum's expense) for a microcomputer course at the local university.

Systematic Collections

The nature of museum work creates an important and obvious role for the computer. Aside from their display and educa-



tional functions, museums serve the scientific community by gathering objects together in groups, preserving them, and organizing them according to some easily understood filing system.

These "systematic collections" provide the basis for scientific studies involving taxonomy (how many kinds of zebras are there?), distribution (where have Stone-Age tools been unearthed in Africa?), morphology (how many stamens are in the average rose?), and ecology (when and where has DDT shown up in bird eggshells?), and other specialized topics.

But to be worthwhile to science, each specimen must be adequately labelled with name, provenance, date of acquisition, and other information. Because collections in a single institution may be very large, managing scientific collections as

databases can be a difficult and time-consuming job. Thanks to the computer, however, this no longer needs to be the case.

After studying the advantages of computerization, many larger museums began to automate their collection systems in the 1970s. Unfortunately, small, less well-funded institutions cannot always afford the luxury of installing an in-house, computerized collection database. Smaller institutions for the most part found the installation and staffing costs overwhelming. For these museums, however, a number of more cost-effective methods of establishing computerized collection databases are being explored by institutions in the United States and Canada.

Lower-Cost Alternatives

Networking is one alternative being explored by the Waterloo Museum Computer Network in Ontario, Canada. The network is comprised of ten museums, each of which has developed its own particular collection data-management procedures. IBM PCs at each museum are used as terminals to a linked system of six IBM 4341s at the University of Waterloo. This arrangement provides users with a potential 66 megabytes of RAM memory and 43 gigabytes of storage.

At peak times, as many as 500 users are on line, according to Dr. Elliott Avedon, director of the Museum and Archive of

PC-PLOT TEKTRONIX 4010 TERMINAL EMULATOR FOR THE IBM PC

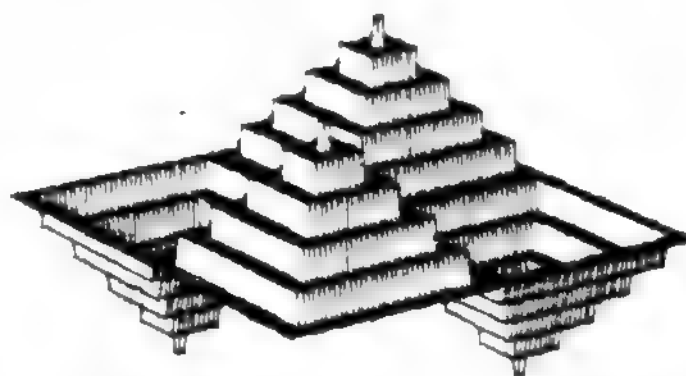
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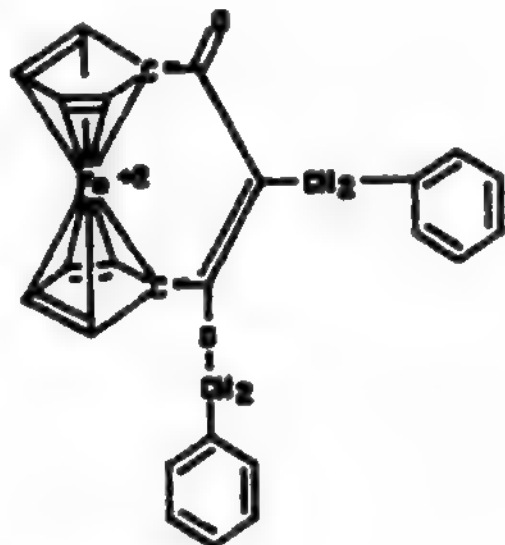
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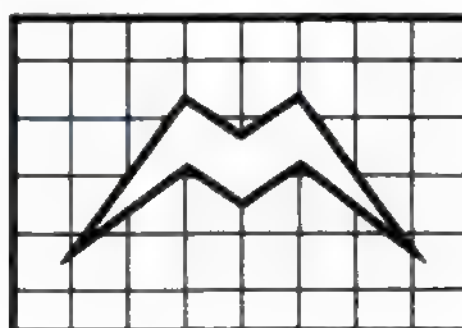


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**MicroPlot
Systems**

1897 Red Fern Dr.
Columbus, Ohio 43229
614-882-4786 TelexEASY LINK 62186730

Games at the University of Waterloo. Each PC in the network has 512K RAM, an asynchronous adapter, a modem, graphics and monochrome boards, a virtual disk, and an Epson FX80 printer. Software for standalone use includes *VisiCalc*, *WordStar*, *ProKey*, *PC-File*, and the IBM DOS 2.0 utilities.

Another alternative is the system developed by Dr. Clifford M. Wetmore of the Department of Botany, University of Minnesota, St. Paul. Wetmore is a specialist in lichens. Systematic collections of lichens are useful to scientists studying the nature of fungus species and ecology. About 60,000 specimens of dried lichens are filed in the cabinets of the University of Minnesota, curated by Dr. Wetmore.

The entire collection has been computerized, meaning that label data such as the lichen's name, where it was collected, what it was growing on, who collected it and when, and museum access number, are now available in a computer database. Among other scientific uses, maps of the geographic distribution of different species can be called from this information.

A computer buff, Wetmore built a "home design" 12-bit minicomputer

from scratch 10 years ago by making his own circuit boards and power supply. Later he put together an 8-bit Altair 680 MITS from a kit. For office work, Wetmore uses a PC with 256K RAM, which he configures as a terminal for the University of Minnesota's Cyber 74 when working with the lichen collection database. His communication with the mainframe is through a Hayes Smartmodem 1200 at 1200 baud with an inexpensive but sophisticated software package developed by the University Computer Center. For information on this package, write to the university at 227 Experimental Engineering, University of Minnesota, Minneapolis, MN 55455. He uses *System 2000 (S2K)* software produced by the MRI Systems Corporation in Austin, Texas, for input and manipulation of data on the mainframe. Wetmore has written an interactive program in BASIC for easy entry of herbarium specimen label data and another program that alphabetizes long lists of species names. He's willing to share them with anyone who sends a formatted IBM diskette and postpaid mailer to him at 220 Biological Sciences Center, University of Minnesota, St. Paul, MN 55108.

Testing Ground

Museums make ideal testing grounds for the data management capabilities of the IBM PC and the software written for it. The computerization of museum collections, however, is also a trial for the curator. Typically, specimen labels are often scrawled in longhand, in foreign languages, with place names absent from modern maps, and often misspelled to boot. Curators have to make some basic decisions about the format and vocabulary to be used in entering data before they first lay hands on a keyboard. Distinctions such as, "Is this an arrow head or an arrow-head?" are enormously important for good data retrieval. A lack of precisely this kind of planning torpedoed many of the collection-computerization projects begun in the 1970s.

Great strides have been made in data management of systematic collections, and talented curators such as Avedon and Wetmore continue to push back the frontiers every year. But the task is complex and large problems remain. Success still requires a hefty portion of individual skill and dedication. In other words, it's up to you, and your PC. ■



Three dolls from the Strong Museum's extensive collection.

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There is no obligation when you enter the "Name our Product" contest. Simply pick up an official entry blank from any participating IBM PC dealer. While you're there, your dealer can give you complete details on the "ELECTRONIC" DISK. Or, you can request an entry form and details directly from the factory by writing to the address below. Please include a stamped, self-addressed business size envelope.

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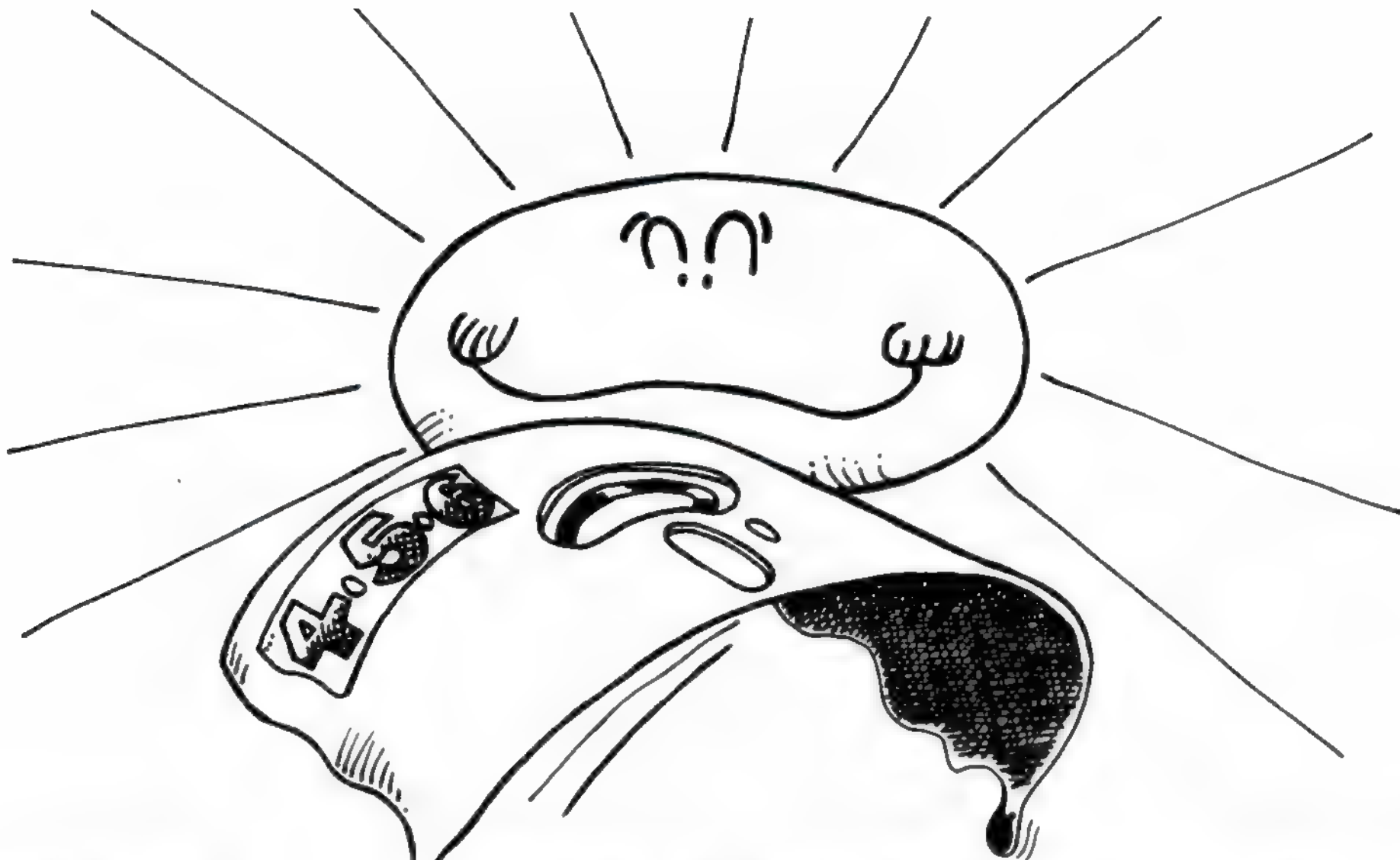
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WildCard 2 (formerly The Alaska Card)

Designed by us and produced by Eastside Software, WildCard 2 is the easiest-to-use, most reliable card available. Making backups of your total load software can be as easy as pressing the button, inserting a blank disk and hitting the return key twice. WildCard 2 copies 48K, 64K and 128K software, and, unlike other cards, is always ready to go. No preloading software into the card or special, preformatted diskettes are required. Your backups can be run with or without the card in place and can be transferred to hard disks. For the Apple II and IIe, \$139.95 complete.

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This is THE disk backup program for the IBM PC, PC/XT and PCjr that copies almost anything. Others may make similar claims, but in reality, nothing out performs Copy II PC . . . at any price. Copy II PC even includes a disk speed check and is another "best buy" at only \$39.95.

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New On The Market

HARDWARE

PC Bubble Disk

A memory expansion board built around a half-megabyte of bubble memory chips, designed to emulate a hard disk drive. The board provides many of the convenient features of hard disk storage units without requiring external power supplies.

The PC Bubble Disk board responds to fixed disk commands under PC-DOS 2.0, Softech Pascal IV.13, and CP/M-86. Software features such as the RESTORE and BACKUP commands, as well as the ability to partition memory to hold several operating systems, are available to the user. With the AUTOSCAN ROM BIOS option installed, the board can also cold boot any of the above listed operating systems.

The PC Bubble Disk card contains four Intel 7110 bubble memories with one-eighth megabyte capacity each. Mean access time (40 msec) and data transfer rate (400 k/sec) allow file transfer operations to take place several times faster than with floppy drives. (List Price: \$1495)

Helix Laboratories, Inc.
16776 Bernardo Center Dr.
San Diego, CA 92128
(619) 451-0270

CIRCLE 800 ON READER
SERVICE CARD



Micro D-CAM, Micromint Inc.



ShuffleBuffer, Interactive Structures

ShuffleBuffer

A printing buffer with a random access printing mode. This capability permits "shuffling" of text, graphics, spreadsheet data, and other computer-generated material, into any desired combination for printing, plotting, or telephone transmission.

The unit also has two ad-

ditional modes of operation: the standard buffer function of first-in, first-out (FIFO) printing of material that does not need rearranging or reprinting, and Bypass, to interrupt a long printout in order to produce a separate document on an immediate basis.

The ShuffleBuffer front panel controls permit equipment stacking, and comes

with all necessary cables to connect to a serial or parallel port in the user's system. (List Price: 32K \$299; 64K \$349; 128K \$445)

Interactive Structures Inc.
146 Montgomery Ave.
Bala Cynwyd, PA 19004
(215) 667-1713

CIRCLE 799 ON READER
SERVICE CARD

Micro D-CAM

A digital image sensor, permitting a user's system to accept visual images as input. Using a 256×128 silicon array and menu-driven software, the Micro D-CAM can interpret, enhance, or store images in computer memory. The complete unit consists of the lens, Optic RAM, interface card, remote housing, extension cable, operator's manual, and utility software.

Typical uses for the Micro D-CAM include graphics, pattern and character recognition, robotics, process control, and security. The included software provides utilities for automatic exposure control, multi-level grayscale, screen dumps, picture storage, and image enhancement.

(List Price: \$295)

Requires:

Micromint Inc.
561 Willow Ave.
Cedarhurst, NY 11516
(516) 374-6793

CIRCLE 784 ON READER
SERVICE CARD

HARDWARE

The Data Library

A 64 megabyte removable-cartridge drive with interface. The unit appears to a user's system as four 16-Mb drives accessible as drives C, D, E, and F. The included interface adapter comes with 64K RAM on-board for directory storage. This memory may be increased in increments of 64K up to a total of 256K. The additional RAM may serve as either a data buffer or as system memory.

The Data Library utilizes a pre-formatted removable tape cartridge. The tape used provides modified frequency modulation recording on 16 tracks with a density of 10,000 bits per inch and unlimited record replacement. Pre-formatting makes use of permanent forward/reverse-reading block keys that establish block locations. Each block contains 1,024 bytes of user data, plus synchronization, header, and error detection information.

The unit can transmit data in either of two modes. In burst mode, it can transfer at a rate up to 4 megabytes per second. The average data transfer rate is 35 megabytes per second.

(List Price: \$2,900 to \$4,900, depending upon system configuration)
Advanced Digital Information Co.

723 Ninth Ave., Bldg. A

Kirkland, WA 98033

(206) 822-5579

CIRCLE 730 ON READER
SERVICE CARD

Brother HR-25 Printer

A daisy wheel printer providing a 23 characters-per-second print speed with features such as proportional spacing, auto space underlining, super/sub script, bold printing, a copy feature, character pitch selection, line pitch selection, memory clear, and two-color printing using a cassette-type ribbon.

The HR-25 is available

with either a serial or parallel interface. Options available include a bi-directional tractor feed that eliminates slack that occurs with single-direction tractors, and an auto cut sheet feeder.

(List Price: approx. \$1,000)

Dynax, Inc.

5698 Bandini Blvd.

Bell, CA 90201

(213) 260-7121

CIRCLE 794 ON READER
SERVICE CARD

IBM PC Color Printer

A color dot matrix printer that can produce documents and graphics in as many as

eight colors. The unit offers user-selectable operating speeds of 200 characters per second (cps) in draft mode, 110 cps for correspondence, and 35 cps for high quality printing. The Color Printer can accept single sheet, fan-fold, and continuous rolls of paper without additional feeders or optional attachments.

(List Price: \$1,995)

IBM Corp.

Entry Systems Div.

P.O. Box 2989

Delray Beach, FL 33444

(305) 241-7662

CIRCLE 785 ON READER
SERVICE CARD



Brother HR-25 Printer, Dynax, Inc.

CC 141 Color Display

An RGB color video display with a resolution of 640×200 dots in a 5×7 matrix, capable of displaying 80 columns by 25 lines. The 14-inch diagonal monitor is fully compatible with 16-bit operations, and can display up to 256 colors simultaneously from either digital or analog input signals.

The CC 141 Display features a synchronizing polarity switch permitting it to be used with many personal computers. Connection to a user's system is via a standard square 8-pin connector. User controls include power on/off, brightness, contrast, V-hold, H-hold, V-size, and V-position.

(List Price: \$795)

Roland DG

7200 Dominion Cir.

Los Angeles, CA 90040

(213) 685-5141

CIRCLE 795 ON READER
SERVICE CARD

Gen*net 1261

A data concentrator, designed to multiplex four or eight asynchronous computer data-entry stations over a single communications link, at composite data rates up to 19.2 kilobytes per second. The device also offers fifteen channel data rates, down line loading, diagnostic circuitry, CCITT compatibility, and local echo-plex. It can be used with

most networks without modifications to hardware or software.

(List Price: Two units: 4 channels \$1,330; 8 channels \$2,090)

General DataComm Industries, Inc.

1 Kennedy Ave.

Danbury, CT 06810

(203) 797-0711

CIRCLE 796 ON READER
SERVICE CARD

CB-141 Color Display

A color monitor utilizing an NTSC composite color input signal, and incorporating au-

dio circuitry and speaker.

The monitor's 13-inch diagonal screen can produce 40 columns by 25 lines on a 5×7 dot matrix, with a horizontal resolution of 270 lines. The unit can be used as a video monitor in combination with a user's system and/or a videotape recorder.

The CB-141 Display is protected from erroneous operation of a floppy disk drive, and is shielded against magnetic interruption from other electronic devices. Input for both audio and video signals is via

twin RCA-type jacks. Interface cables for a range of personal computers are available separately.

(List Price: \$395)

Roland DG

7200 Dominion Cir.

Los Angeles, CA 90040

(213) 685-5141

CIRCLE 790 ON READER
SERVICE CARD

VideoPrinter Model 8

An instant color film recorder for making 8×10 inch photographic reproductions of screen images. The Model 8 is a microprocessor-controlled unit that digitizes the video signal, calculates gray-scale transfer functions for each color, and matches contrast, density, and other exposure parameters to the film type being used. The device can make continuous-tone, full-color 8×10 inch overhead projection transparencies on Colorgraph instant film, and 8×10 inch color prints on Polaroid ER instant film.

Automatic settings for brightness, contrast, and color balance can be manually adjusted to enhance highlight and shadow detail in the photographic copy.

(List Price: \$6,600; with processor, film holder, and loading tray \$7,753)

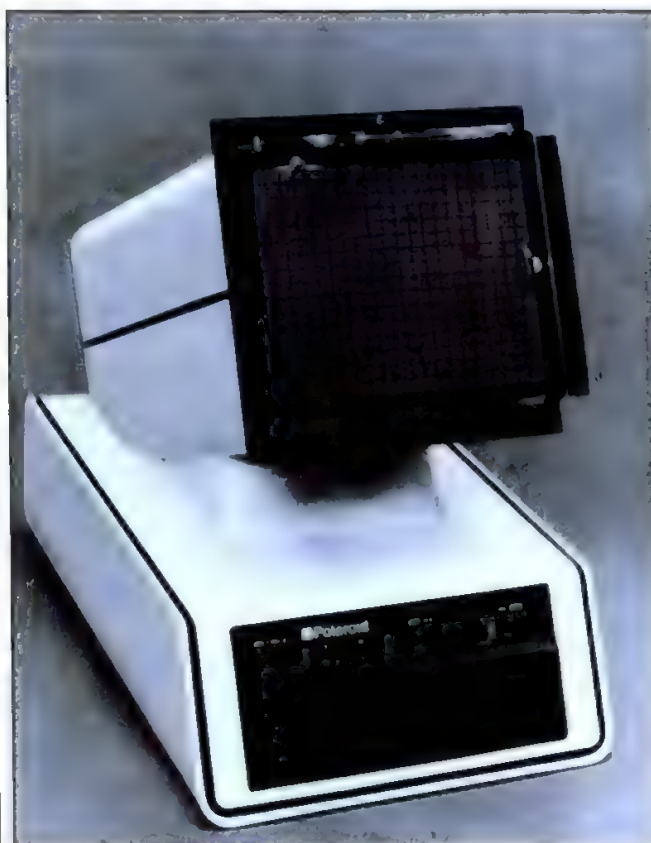
Polaroid Corp.

575 Technology Sq.

Cambridge, MA 02139

(617) 577-2000

CIRCLE 789 ON READER
SERVICE CARD



VideoPrinter 8, Polaroid Corp.

HARDWARE

Smart Switch

A device permitting up to eight RS-232 ports to be used in any interconnection. Push buttons for each port define the port as either DTE or DCE. Up to four pair of ports can communicate at the same time.

The Smart Switch is controlled by software commands, with a two character sequence for port selection, status determination, and log-off. If the selected port is busy, the unit will inform the user's system when it becomes available.

The device can operate at baud rates from 150 to 9600 bps, with all ports operating at the same selected rate.

(List Price: \$895)

Western Telematic Inc.
2435 S. Anne St.
Santa Ana, CA 92704
(800) 854-7226
(714) 979-0363

CIRCLE 787 ON READER
SERVICE CARD

DXY-101 Plotter

An X-Y plotter with an interchangeable pen, capable of plotting at speeds up to 180mm per second on any type of paper. The unit can accommodate paper up to 11 x 17 inches in size, and has a 10¼ x 14½ inch plotting area. Features include both a serial (RS-232) and a parallel (Centronics) interface, 16 different print sizes, and 8K of on-board memory to help simplify program commands.



PC-CARD, Alloy Computer Products

The device also incorporates dual speed switches, BASIC language compatibility, and an L.E.D. indicator for power on (steady state) or error condition (blinking).

(List Price: \$750)

Roland DG
7200 Dominion Cir.
Los Angeles, CA 90040
(213) 685-5141

CIRCLE 798 ON READER
SERVICE CARD

Supercord

A typewriter interface, permitting a variety of typewriter models to be used as computer printers. Supercords are available in serial RS-232C, IEEE-488, or Centronics parallel connectors, and can be user-in-

stalled in typewriters from Adler, Brother, Royal, Smith-Corona, Silver-Reed, and other manufacturers.

Also available is Supercord II, containing a 4K print buffer memory which permits a user's system to continue receiving input even while the typewriter is printing the previous input. Both versions of Supercord allow typewriters to continue to be used as stand-alone devices.

(List Price: Both versions \$295)

Cord Ltd.
1548 Brookhollow Dr.
Santa Ana, CA 92705
(714) 545-1643

CIRCLE 788 ON READER
SERVICE CARD

PC-CARD

A credit card reader that attaches to a user's keyboard. The user slides a credit card or similar card with a magnetic stripe into the PC-CARD slot to enter the card's data into the system. The device can be used for virtually any identification purpose such as security access control, password input validation, credit card transactions, and data logging. A sample BASIC program is provided with the unit.

(List Price: \$279)
Alloy Computer Products
100 Pennsylvania Ave.
Framingham, MA 01701
(617) 875-6100

CIRCLE 786 ON READER
SERVICE CARD

HARDWARE/SOFTWARE

RX-80 F/T Printer

A new version of the Epson RX-80 dot matrix printer, featuring both tractor and friction paper feeds. The unit can print at speeds up to 100 characters per second, with a choice of two 96-character ASCII sets plus nine international character sets and 32 special graphics characters. Users may choose from 128 type styles, including emphasized, doublestrike, elite, and italics.

Other features of the RX-80 F/T include a disposable printhead; logic-seeking, bi-directional printing; an underline mode; and a special Quiet Mode that reduces the unit's overall noise level.

(List Price: \$599)

Epson America, Inc.
3515 Kashiwa St.
Torrence, CA 90505
(213) 539-9140

CIRCLE 793 ON READER
SERVICE CARD

Multifunction Boards

Two boards fitting one slot each in a user's system, providing additional RAM memory and additional parallel and serial ports. The RIO PLUS board has the capacity for adding up to 384K of RAM, plus an asynchronous RS-232 serial communications port, a parallel port, a battery-operated clock/calendar, and a game port compatible with joysticks.

The SUPER I/O board is

designed to fit the short slot of a PC-XT as well as a regular slot in the PC, and provides a parallel I/O port, an asynchronous RS-232 serial communications port, a battery-operated clock/calendar, as well as a joystick game port.

Both boards include PC Accelerator software, providing the user with an electronic RAM disk and print spooler.

(List Price: RIO PLUS 64K-384K \$385-\$845; SUPER I/O \$229)

STB Systems, Inc.
601 N. Glenville, #125
Richardson, TX 75081
(214) 234-8750

CIRCLE 791 ON READER
SERVICE CARD

One Megabyte RAMPLUS

A single plug-in board incorporating new 256K RAM chips, for a total of one megabyte of memory on-board. The board can also accept 64K chips, or a

combination of both types for special applications and memory management.

RAMPLUS has a proprietary PROM-controlled memory mapping facility that automatically translates memory locations in the hardware.

RAMPLUS accepts up to four banks of RAM, each bank configured as eight data bits and one parity bit. Parity error detection logic on the board may be enabled or disabled with a DIP switch. Other functions of the RAMPLUS board include both a serial and a parallel port and clock/calendar with battery back-up.
(List Price: Board without RAM \$319; 1Mb RAM \$1,839)

Raytronics
4901 Morena Blvd.,
Bldg. 900
San Diego, CA 92117
(800) 854-1085
(619) 270-4000

CIRCLE 792 ON READER
SERVICE CARD

SOFTWARE

Genieology

A genealogical program, allowing a user to track and maintain data on family members. Data fields include member's full name, with a separate entry for legal name if different; birthday and place of birth; date and cause of death; spouse data, including names, dates of birth, dates and places of marriage, children's names and birthdays, etc.

The program includes provisions for entering a running log of research documents related to family members, and to print out family records (including pedigree charts of four or five generations) through as many generations as are included in database, without limit to the number of ancestors for which information can be stored. The program can search for members by name, birthday, or the name of spouse, and allows a user to custom code data to facilitate transferring existing records.

(List Price: \$359)

Requires: 128K, two disk drives, PC-DOS or CP/M-86, monitor, printer.

Warner Enterprises
P.O. Box 6276
Glendale, CA 91205

CIRCLE 725 ON READER
SERVICE CARD



RX-80 F/T Printer, Epson America



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Diablo 630R (40CPS)	\$1839
Diablo 630KSR (40CPS)	\$2599

Epson

FX 80	\$ 599
FX100FT	\$ 799

Okidata

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ML83A	\$ 615
ML84P	\$1049
ML84S	\$1149
ML92P	\$ 469
ML93P	\$ 789

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MT 1802 (Parallel)	\$1689
MT 1805 (Serial)	\$1689

Gemini

Gemini 10	\$ 315
Gemini 15	\$ 439

Qume

Qume Sprint II	\$1429
Tractor Feed	\$ 175
Printer Interface	\$ 89

CP/M 8"

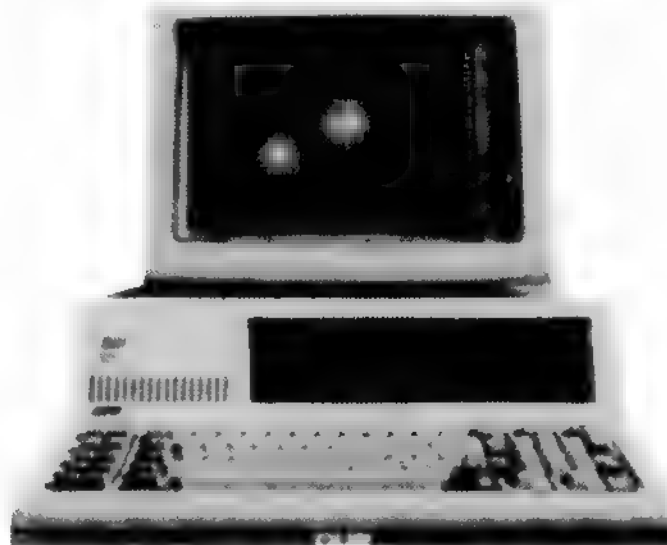
Digital Research

CBasic	\$ 99
C Basic Compiler CB-80	\$ 329
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Access Manager	\$ 199
Display Manager	\$ 263
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Infostar	\$ 299
Reportstar	\$ 209

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DataStar	\$179
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SpellStar (CP/M 80)	\$149

New Products



IBM System
\$3,029.

Call for Pricing and Configuration

Colorplus color graphics card
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one parallel port, one serial port,
clock calendar \$269
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Quad 512 # installed \$649
Quadlink (Apple/IBM interface) \$499
Quadcolor I \$215
Quadcolor II (hi-resolution) \$199

Specials of the Month

Microsoft Mouse	\$134.00
Hayes Smartmodem 1200B w/Smartcom II Complete Plug In System	\$429.00
Elephant Disks D/D	\$ 30.00
Verbatim Disks (S/D w/library case)	\$ 25.00
Maxell Disks (D/D)	\$ 40.00
Flip & File Diskette Box (Holds 50 Disks)	\$ 21.00
Flip & File Diskette Box w/lock (Holds 25)	\$ 18.50
Diskette Mailers (5 to pkg)	\$ 3.50
Diskette Holder Box (multi-color, holds 10)	\$ 2.50
Disk Savers (Protector Sleeves, Box of 12)	\$ 4.50
Orange Surge Protector	\$ 95.00
Perfect Data Head Cleaning Kit	\$ 19.00
Koala Touch Tablet	\$115.00
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Monitors

Amdak

Amdak Color II	\$449
Color III	\$399
Amdak V310 Green	\$179
Amdak 310 Amber	\$189

NEC

NEC JB 1201M	\$189
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Gorilla Monitor (Hi-Res) Green	\$ 85
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USI

Amber Monitor 12"	\$159
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Quadram

Quadchrome

- Hi-Res RGB Monitor
- Non-Glare Screen
- 690 x 240 Resolution

\$549

Peripherals

Kraft Joystick	\$ 45
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TG Trackball	\$ 39
Microsoft 64K Ramcard	\$239
Microsoft 256K Ramcard	\$589
Hayes Smartmodem 300	\$209
Hayes Smartmodem 1200	\$499
Hayes Smartcom II Terminal Pk.	\$ 72
Anchor Automation Mark VI Modem	\$179
Quadram Microfazer w/Power Supply 32K	\$165
Versawriter Graphics Tablet	\$239
Koala Touch Tablet	\$ 85

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of AST Research**

Megaplus II 64K .. \$289
Comboplus 64K .. \$289
Comboplus 256K .. \$525

Corona

Desktop Computer

IBM Compatible Includes Two drives,
128 K memory. Graphics, serial/parallel
ports, hi-resolution monitor, MS DOS,
GW BASIC, Multimate wordprocessing,
PC Tutor.

\$2595

Corona

Portable Computer

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SOFTWARE

Oper8

A set of three interactive programs, intended primarily for the PC-XT, to help managers control sales, purchasing, and inventory operations. The software is written in dBASE II, and both single and multi-user configurations are supported. The *Purchasing and Sales Order Control* programs can operate independently, while the *Integrated Inventory Management* program requires both.

The *Purchasing* program's features include an open purchase order file; a purchase order history file; the ability to print purchase orders; the ability to record receipt of goods or services, as well as verify vendors' invoices; and the ability to cancel orders and return goods to vendors for credit.

The *Sales Order Control* program can create and maintain a sales backlog file, and print work orders and backorders; modifies existing orders as needed; records shipments, prints invoices; credits and restocks returned goods; and maintains a sales history file.

The *Integrated Inventory Management* program updates inventory as a result of sales and purchasing; supports both finished goods and component inventories; provides multi-level Bill of Materials printing capabilities; provides time-phased material requirements plan-



PICTUREWRITER, Scarborough Systems

ning capabilities; and supports products with options and complex pricing.

(List Price: *Purchasing* \$500; *Sales Order Control* \$750; *complete Inventory Management* \$2,250)

Requires: PC-XT, 128K, 5 Mb Hard Disk, PC-DOS 2.0.

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17131 Hofer Ct.
Lake Oswego, OR 97034
(503) 241-8448

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A children's graphics program, featuring built-in tutorial sets showing the user how to control joysticks and keyboards to manipulate drawings on the screen. The on-screen command sets allow the user to begin working with the software without extensive study of the accompanying manual, to alter shapes, change designs, and fill-in with colors chosen from the software's on-screen color palette.

Users of *PICTURE-*

WRITER can create original drawings, or choose from a collection of included pre-programmed artwork. Pictures can be saved to disk, for later redrawing or recoloring.

(List Price: \$39.95)

Requires: 64K, one disk drive, PC-DOS, color monitor, color/graphics adapter.
Scarborough Systems, Inc.
25 N. Broadway
Tarrytown, NY 10591
(914) 332-4545

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NAMOR

A mailing list management program featuring five menu screens providing the operator with control over the program's functions. *NAMOR* can sort lists on any or all of the 10 elements of each listing, and provides searching and selecting capability, match searching, tagging of entries, and formatting of printouts for labels and directories. The program is compatible with most word processing software.

(List Price: \$150)

Requires: 64K, two disk drives, PC-DOS or CP/M-86.

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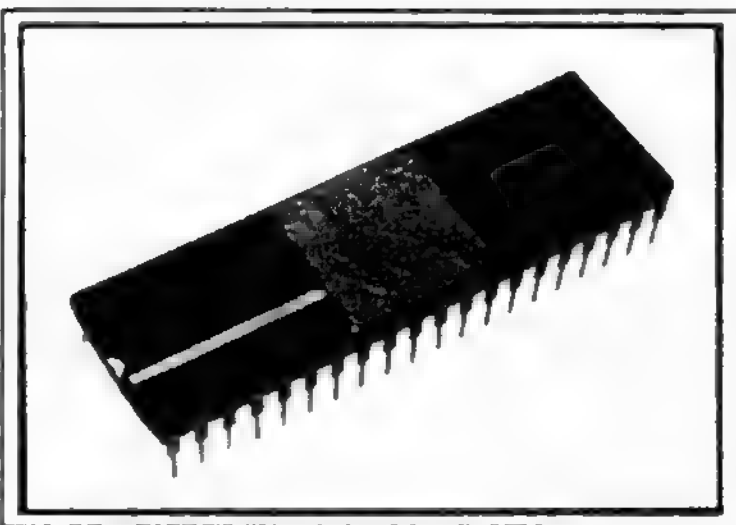
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SOFTWARE

AMP-PC

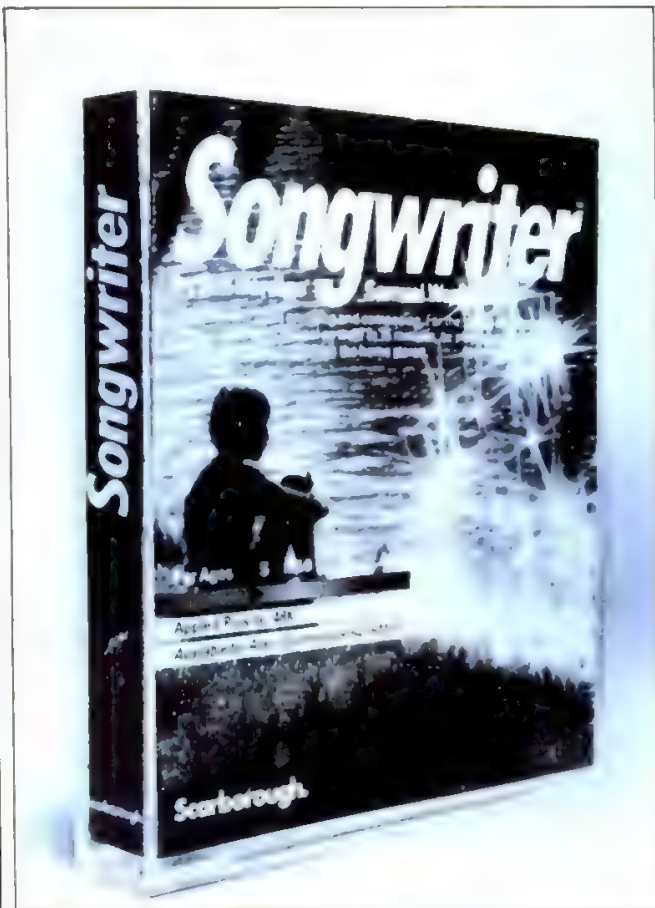
A portfolio management program permitting all securities transactions and similar data to be entered in real time and immediately affect the database. AMP-PC uses standardized screens and menus, and allows for securities transactions under tax-lot (FIFO, LIFO, High/Low Cost) and average accounting methods. The program has provision for sector analysis, performance measurements, and for modeling and forecasting. Prices may be changed on-line and immediately affect all produced reports.

AMP-PC can produce more than 20 reports on-line or directed to a printer. Reports include operational and client oriented trade blotters, holdings and forecast evaluations; realized and potential gain and loss reports; and performance measurement on absolute, comparative, and strategic bases.

The program is also available for use with mainframe systems. Each AMP implementation can communicate with any other AMP installation, allowing up- or downloading of data between different systems.

(List Price: Rentals start at \$1,000 per month)

Requires: 256K, 10 Mb Hard Disk, PC-DOS.
Securities Information Services, Ltd.
23 E. 10th St.



SONGWRITER, Scarborough Systems

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SONGWRITER

A music composition program featuring graphics and a simple to follow command structure which remains on the screen throughout the program. The software allows a user to compose music, with one-key control over the position of notes

on the scale, the tempo of the new composition, and the saving of the composition to diskette. The program also includes a pre-programmed library of 28 songs, including "Row, Row, Row Your Boat" and Mozart's "Minuet in G."

SONGWRITER can be used as an illustrative tool to depict the mathematical basis of musical forms, and as compositional aid for linking different musical

ideas together quickly. Output can be through a home stereo via an included connector, and/or through a printer, providing a note-by-note printout for future use.
(List Price: \$39.95)

Requires: 64K, one disk drive, PC-DOS, color monitor, color/graphics adapter.
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A COBOL screen code generating program. Once the programmer has positioned literals and defined variables, SCREEN.COBI automatically generates four COBOL files: an input screen (entry), an output screen (display), an edit module, and a record declaration. The program eliminates counting out rows and columns to position literals on a screen. Variables can be defined as required, or set for auto, or neither. Multiple screens can be set up at once.

(List Price: \$49.95)

Requires: 64K, two disk drives, PC-DOS, monitor, IBM or MicroSoft COBOL.
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The Technical Investor, Savant Inc.

The Individual Tax Program

A tax estimation program for 1983 tax planning. This release in the *MCM Tax Series* allows users to evaluate the effects of different tax strategies and investment alternatives on tax liability. *The Individual Tax Program* calculates tax liabilities using IRS tables and rate schedules for standard, income averaging, and alternative minimum tax methods of calculation.

(List Price: \$189)

Requires: 128K, one disk drive, PC-DOS.

MCM Systems, Inc.
2706 Richmond, #100
Houston, TX 77011
(713) 522-1700

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The Technical Investor

An investment data management program, containing communications, charting, and technical analysis modules. The program features a graphic command screen that relies on numeric data entered to access the program's various modules. All of the program's components can be accessed from a single screen, instead of from a series of menus. The program can handle data on every type of security for which historical or daily information is provided by the Dow Jones News Retrieval Service database, including the Dow Jones Industrial,

Transportation, Utilities, and Composite averages.

The program's communications module can automatically dial-up and access required data from either the Dow Jones or the Warner Computer Systems databases, and can update any or all of the securities on disk. After each update, a summary report is prepared of the prices, volumes, and changes since the previous update. Up to a year of data can be accessed and retrieved with a single keystroke.

The securities database component of *The Technical Investor* allows a user to follow stocks and other securities at varying time intervals per type of security

without requiring different diskettes. An included editor allows manual entering and editing of data.

The charting module permits a user to choose one to four independently controlled windows on-screen, each one capable of displaying any of the charts available. This module also permits a user to define up to 26 procedures to keys, including the 10 function keys. All user-defined procedures and key definitions are stored on the program disk, instead of on data disks.

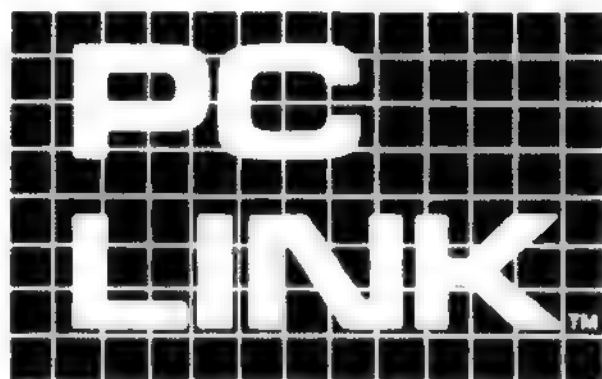
Charts available include price and volume bars; High, Low, and Close prices; point and figure charts; five different price/volume indicators; regressions; oscillator functions; exponential and moving averages; and relative strength plots. Multiple stocks can be plotted on the same screen, or charts can be displayed side by side for comparisons.

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Requires: 128K, two 320K drives, PC-DOS, color or monochrome monitor, color/graphics adapter, Hayes Smartmodem or Novation SmartCat, graphics printer. *Savant Corp.*

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IN NEW YORK CALL 1-212-730-8036

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the manufacturer. All goods are shipped U.P.S. only. Add 2% of price, or minimum of \$3.00 for shipping. We do not ship C.O.D. Please allow one to two weeks for personal or corporate checks to clear. To expedite shipping send money order, certified cashier's check, or charge to your VISA, MasterCard, Diners, Carte Blanche WE DO NOT Add a Service Charge For Credit Card Usage. Prices subject to change without notice. NOT RESPONSIBLE FOR TYPOGRAPHICAL ERRORS.

SCREEN MANAGER/PASCAL

A Pascal programming tool, providing the programmer with a means to develop full screen interactive applications quickly. *Screen Manager* includes a "screen painting" editor used to lay out displays for the application. The program then produces a screen map file for run-time use, and a Pascal record description for the application. At run time, the application uses high-level *Screen Manager* functions to display screens of output and obtain input. (List Price: \$89; demo disks and manual \$29)

Requires: 128K, two disk drives, color or monochrome monitor, IBM Pascal Compiler.

KT Systems
6550 Crystal Springs Dr.
San Jose, CA 95120
(408) 997-6138

CIRCLE 751 ON READER SERVICE CARD

A.C.E. (Asynchronous Communications Emulator)

A terminal emulator program allowing a user to link with a Honeywell distributed processing network through emulation of Honeywell VIP7200/7201 terminals. Features of *A.C.E.* include: the use of the standard Honeywell terminal in-

terface; full cursor control and use of the standard seven function keys of the VIP720x terminals; data transfer rate selectability from 300 to 9600 baud; auto redial/connect for dial-up networks; and the ability to select COM1 or COM2 as the user's communications channel.

(List Price: \$495)

Requires: 128K, one disk drive, PC-DOS, asynchronous communications port.

Insurance Technology Consultants
1437 W. Palmyra, #F
Orange, CA 92668
(714) 773-1754

CIRCLE 738 ON READER SERVICE CARD

METAFILE

A database management/applications development sys-

tem, providing facilities for high-level programming, word processing, database creation and management, financial data modeling, and report generation in an integrated manner. Intercomputer telecommunications, file format conversions, and access to other programs are standard features of *METAFILE*.

The software incorporates an "Assistant" facility to aid the user through on-line documentation of the software's features, providing prompts, multiple window displays, and selection menus for ease of use. As the user becomes more fluent with *METAFILE*, it is possible to override the prompts and menus to enter data directly into the applications created by the user.

METAFILE permits:

- Formulae (calculations) to refer to any database item or variable;
- Text to contain embedded formulae to be evaluated on-screen or in print;
- User menus to be designed and edited on-screen;
- Users to write their own procedures to extend the command language;
- Binary as well as character data to be communicated via the *METAFILE* transmission protocol.

(List Price: \$995)

Requires: 128K, two disk drives, PC-DOS, async communications port.
Sensor-Based Systems
15 E. Second St.
Chatfield, MN 55923
(507) 867-4440

CIRCLE 783 ON READER SERVICE CARD



METAFILE, Sensor-Based Systems

Never again worry about computer theft or damage

What could be better than full replacement?

By now, you've probably heard or read about SAFEWARESM Insurance for microcomputers. But you may still wonder just what it protects, or whether it's really worth the investment. If you've never lost any part of your computer system or software, you probably don't yet realize the limitations of most standard insurance coverages. Or the agonies you could face in trying to recover even the simplest piece of peripheral equipment.

What do you mean it's not covered?!

Operating your computer system without SAFEWARE protection is fine as long as you don't have to worry about an accident or loss. But what if you came to your office one morning to find you'd been robbed? Or your home had been ransacked? Or that a pipe had burst and caused water damage? Or that your system, too, had fallen victim to a leading destroyer of micro-systems—a power surge? All events beyond your control. If something like this should happen to you, you're likely to find out the hard way just how limited your standard insurance policy's protection really is. And no matter how little or how much you have invested in your computer system, discovering that it's not covered can be an expensive lesson.

Now you can be sure

SAFEWARE was developed by an insurance professional who was shocked to learn that his very own personal computer was at risk. Can you imagine? What he discovered was that his homeowners insurance policy excluded coverage as soon as he began operating his first business program. Even his simplest spreadsheet voided coverage. Because most homeowners policies *won't cover any equipment used for business*, no matter how infrequently. Out of this need was born SAFEWARE. A simple, easy-to-understand coverage you can count on. Full replacement coverage of hardware, software and media, after a low \$50 deductible.

With SAFEWARE there's no need for you to schedule equipment or software as you do with the "rider" type of policies. So your coverage can grow with your system, providing protection for its full value rather than for each individual item. This will be especially impor-

tant to you if you're ever planning to buy additional equipment or software. Even just one peripheral.

What the editors are saying

Desktop Computing: . . . "Given the amount of money that business users spend on computer equipment . . . it's not too farfetched to say that an insurance policy may be the most important new accessory that you could add to your desktop computer system."

Computer Decisions: . . . "Your personal computer might not be safe at home. If it is not insured, then you're running the risk of losing the thousands of dollars you've invested . . ."

Personal Computing: . . . "Replacing hardware may be more of a problem than you thought it would be . . . That's why (a computer consultant) suggests that you get the computer insured."

Wall Street Journal: . . .

"[SAFEWARE] introduces coverage that insures home computers regardless of use. The usual premium: about \$75 a year."

An All-Risk, no risk offer

SAFEWARE is an *All-Risk* plan of insurance, which means that it covers *all* hardware, *all* purchased software, and *all* media. Your complete system is protected against

theft, fire, accidental damage, even damage sustained while the computer is being transported in your car. SAFEWARE even covers damage caused by power surges . . . the leading destroyer of microcomputers. And, now, SAFEWARE is available on a *no risk* basis. If you are not completely satisfied with the protection afforded by SAFEWARE, you may return the contract for a full refund within the first 10 days after you've received it.

Thousands have said "yes!"

Since it was first introduced in 1982, thousands of computer owners, like you, have said "yes" to the SAFEWARE offer. Owners of systems from the smallest portable micros to larger sophisticated business systems are finding that SAFEWARE offers the most affordable and complete security. And the simplest peace of mind available to ensure carefree computing.

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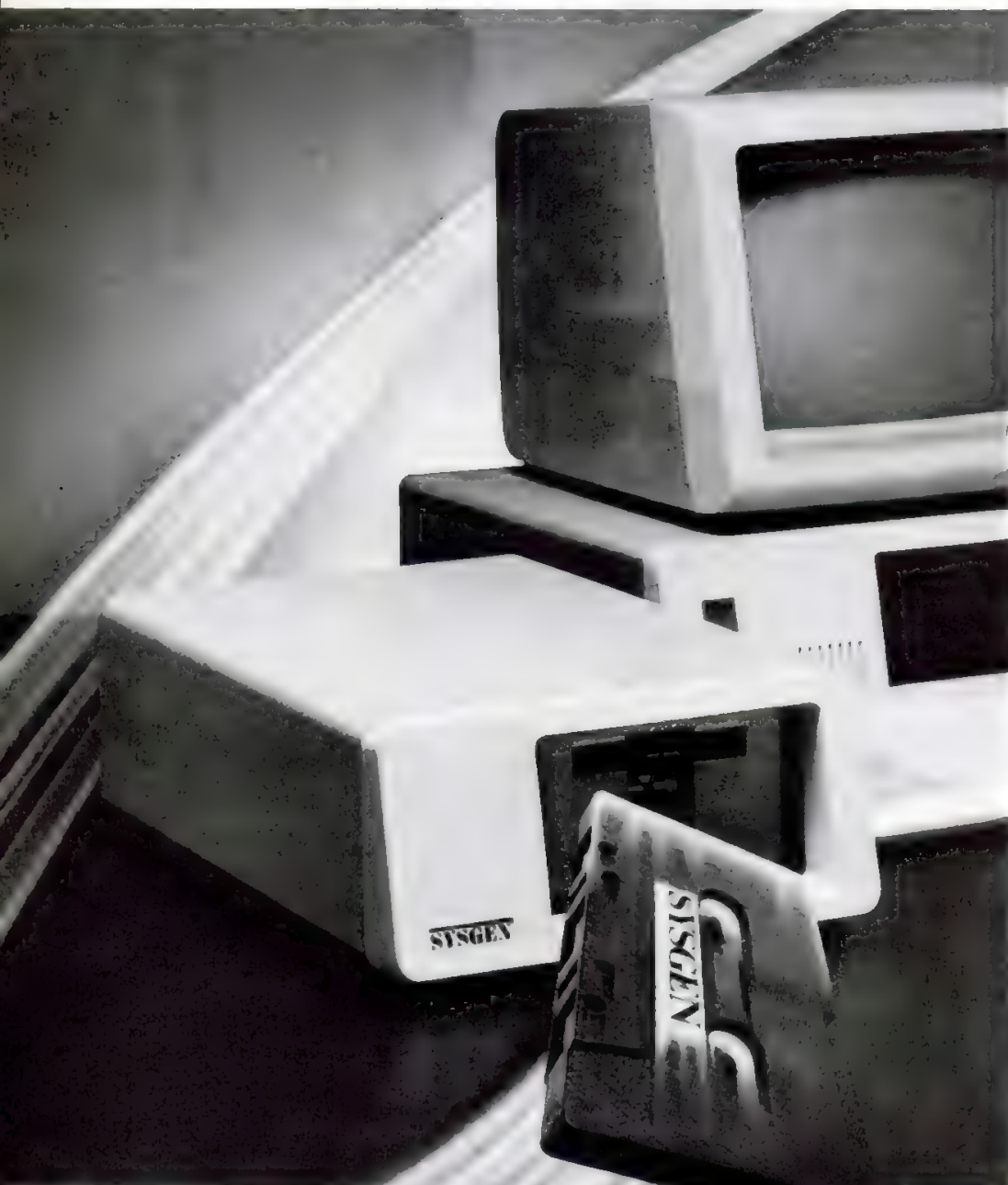
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PCM Columbus, OH 43202

SYSGEN ANNOUNCES TAPE BACKUP FOR THE IBM PC.TM WITH OR WITHOUT HARD DISK.



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Sysgen is delivering complete low-cost Winchester systems with high-speed tape cassette backup.

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And if you own an IBM XT, which includes a hard disk, you can get safe, fast backup with our new Image streaming tape cassette backup system for only \$995.

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For complete information, see the smartest computer store in your neck of the woods. Sysgen, Inc., 47853 Warm Springs Road, Fremont, CA 94539. 800-538-8157 ext. 970; in Calif., 800-672-3470 ext. 970.

SYSGEN
INCORPORATED

CIRCLE 474 ON READER SERVICE CARD

SOFTWARE

Jack2

A database management system permitting a user to perform word processing, spreadsheet, graph charting, and file management tasks within a single integrated format, on one display screen without requiring the use of multiple "windows." The software makes use of icons (graphic representations of commands) and on-screen command lines, allowing a user to simply point to a command using cursor controls to perform required tasks.

Among the features offered by *Jack2* is the ability to handle multiple columns of text on the same page. Text entered or deleted in any of the columns does not change the layout of the other columns, as wordwrap occurs only within each column of text. Pages may be up to 25½ inches wide, as the software can automatically scroll horizontally as needed.

Another feature of the software is the ability to hide scratchpad and confidential information within a text. A "transparent" band allows the user to view and manipulate data in the band, but the information does not appear when the text is printed.

Jack2 also eliminates the need to identify spreadsheet cells by coordinates such as A22 or B57, and users need

not move from cell to cell to establish a formula. The user can simply name the figures for which computations are needed. The software's spreadsheets can accommodate up to 1000 columns and rows, each of which having up to 255 values. Numeric values can be stored in up to 24 digits for precision. In addition, a user can mask a field so that it will accept only formatted values (i.e. social security or telephone numbers).

Jack2's database capabilities provide for the selection of records based on any user-definable criterion. It also allows three-level ascending, descending, alphabetic, and numeric sorts, through icon-driven commands. In addition, database structures can be altered or modified (fields added, deleted, or contracted) without the need to rewrite existing records.

Graphic charting capabilities allow a user to choose to specify the titles and values of the X and Y axes, determine scale, select whether headings fall below the line or above individual bars, plot the graph—or default to *Jack2*, which can set the above parameters automatically.

Two support programs for *Jack2* are also available: *Jack2 Report*, a report generator with the ability to calculate and count as well as

summarize data in user-definable reports; and *Jack2 Utility*, which is used to transfer files to and from *Jack2* files, DIF files, and standard PC-DOS files.

(List Price: *Jack2* \$495; *Jack2 Report* \$250; *Jack2 Utility* \$125)

Requires: 128K, two 320K drives, PC-DOS, monochrome monitor.

Business Solutions, Inc.
60 E. Main St.
Kings Park, NY 11754
(516) 269-1120

CIRCLE 778 ON READER
SERVICE CARD

MATHLETICS

An educational program in the basic arithmetic operations of addition, subtraction, multiplication, and division. The user selects the operation to be drilled, the number of problems, the range of numbers from which the problems will be selected, and the number of incorrect attempts at the answer that the program will allow. Additionally, three special modes of operation are allowed: random computer selection of the operation; preschool mode; and repeat mode to reselect the most recent drill with a new set of problems.

Each drill is personalized with the operator's name and is scored in a manner similar to school tests. The five most recent drill results

are saved and may be recalled for a summary presentation of progress.

(List Price: \$34.95)

Requires: 64K, one disk drive, PC-DOS.

ABS Software, Inc.
P.O. Box 309
Blue Bell, PA 19422
(215) 277-0304

CIRCLE 743 ON READER
SERVICE CARD

MailList/VW

A mail-merge program designed for use with the *Volkswriter* word processing software. *MailList/VW* includes utilities providing the capability to create and maintain multiple name and address files, and to use this data to automatically generate correctly formatted control files for use by *Volkswriter* in preparing form letters or addressing envelopes.

Programs are also included for listing name and address information and preparing mailing labels. The program is written in Microsoft BASIC, and is provided in source code form to allow user modification and enhancement.

(List Price: \$55)

Requires: 64K, two disk drives, PC-DOS 1.1, *Volkswriter*.

Mascot Systems
7022 Bridgeport Cir.
Stockton, CA 95207
(209) 952-4488

CIRCLE 752 ON READER
SERVICE CARD

The Rixon PC212A... The Perfect Modem For Your IBM® PC ...Only \$499

The Rixon® PC212A offers you the only 300/1200 BPS full duplex card modem with auto dial and auto answer that plugs directly into any of the IBM® PC® * card slots. Because the Rixon PC212A was designed specifically for the IBM PC, it is loaded with user benefits.

The PC212A eliminates the need for an asynchronous communications adapter card and external modem cable, this alone saves you approximately \$190. The PC212A provides an extra 25 pin EIA RS232 interface connector, a telephone jack for alternate voice operation, and a telephone line jack for connection to the dial network.

Without question, the PC212A is the most user friendly, most reliable, and best performing modem for your IBM PC. An internal microprocessor allows total control, operation, and optioning of the PC212A from the keyboard.

A user friendly HELP list of all interactive commands is stored in modem memory for instant screen display. Just a few of the internal features are auto/manual dialing from the keyboard, auto dial the next number if the first number is busy and instant redial once or until answered.

In the event of power disruption a battery back-up protects all memory in the PC212A. In addition, the PC212A is compatible with all of the communication programs written for the Hayes Smartmodem™** such as

CROSSTALK.™+ Also available for use with the PC212A is the

Rixon PC COM I,™* a communications software program (Diskette) and instruction manual to enhance the capabilities of the PC212A and the IBM PC. PC COM I operates with or replaces the need for the IBM

Asynchronous Communications Support Program. The program is very user friendly and provides single key stroke control of auto log on to multiple database services (such as The Source SM&), as well as log to printer, log to file transfer and flow control (automatic inband or manual control). PC COM I is only \$49.00 if purchased at the same time as the PC212A. The PC212A comes with a 2 year warranty. For more information contact your nearest computer store or Rixon direct at 800-368-2773 and ask for Jon Wilson at Ext. 472.

PC212A\$499.

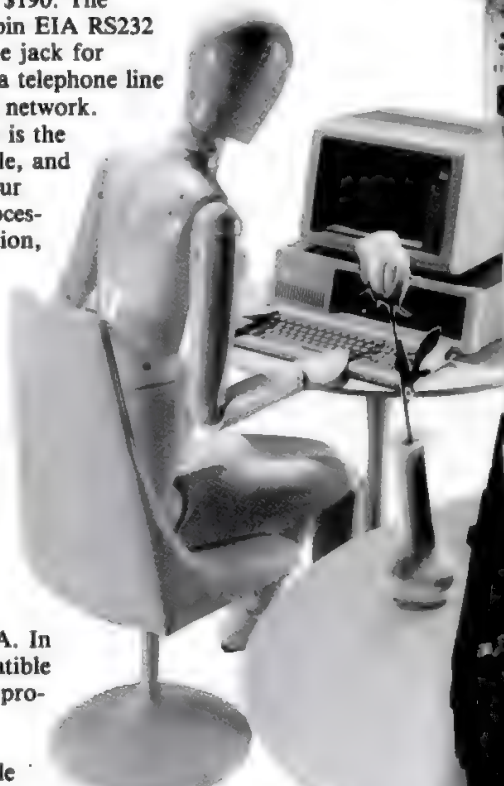
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The Rixon PC212A Card Modem

Another Modem Good Enough To Be Called RIXON



Real Estate Overlays, RealData, Inc.

Real Estate Overlays

A set of five templates for real estate, designed for use with the *Multiplan* spreadsheet program. The templates allow a user to generate 10-year analyses of cash flows and sales proceeds. Calculations possible with the software include depreciation (including capital improvements), by ACRS or S/L; annual debt service; annual interest and payoff amounts for three mortgages; capitalization rates, net operating income, before- and after-tax cash flows, costs of sale, cash-on-cash return and internal rate of return; projected sell-

ing price by capitalization or inflation rate, adjusted basis, capital gain, excess depreciation, recapture, and federal income tax calculations. In addition, the software can produce loan amortization schedules and IRR calculations, and create annual income-and-expense statements.

(List Price: \$120)

Requires: 128K, two disk drives, PC-DOS, *Multiplan*.

RealData, Inc.

P.O. Box 691

Southport, CT 06490

(203) 255-2732

CIRCLE 753 ON READER SERVICE CARD

CREATIVE GRAPHICS, Ver. 2.0

An interactive graphics design and presentation program, featuring drawing routines pre-mapped on function keys, assembly language routines for organizing slide show presentations, and user-definable shade mapping, allowing customization of both color and monochrome dumps.

New features of version 2.0 include: high resolution drawing utilities, with selectable foreground color; customizable text fonts which can be scaled and rotated; additional symbol utilities, enabling the creation of vector symbols which can be scaled and rotated when placed in a drawing; an auto-draw feature, allowing a user to draw a figure, then have it recreated step-by-step automatically (useful in creating simple animation); cursor movement capabilities including diagonal movement, and dynamically adjustable cursor increment and line width; and color features including recoloring, intensity variations, and a new palette of available colors.

(List Price: \$139.95)

Requires: 64K, one disk drive, PC-DOS, color monitor, color/graphics adapter, BASICA, IDS Prism or Epson printer with *GRAF-TRAX*.

Accupipe Corp.
222 W. Lancaster Ave.
Paoli, PA 19301
(215) 296-7376

CIRCLE 749 ON READER SERVICE CARD

DataStar & ReportStar Tutorials

Two interactive tutorials in the use of the *DataStar* and *ReportStar* programs. Each tutorial includes a two-diskette training program and a 50-page handbook with exercises, a reference section, and sample applications.

All principal procedures in both *DataStar* and *ReportStar* programs are explained, including the more advanced procedures such as the use of key fields, resorting data files, and using logical expressions. The sample applications describe how the two programs can be applied to business sales analysis, academic and professional research, professional billing on preprinted forms, keeping track of itemized tax deductions, high volume transaction processing, and other applications.

(List Price: \$59.95 each)

Requires: 64K, two disk drives, PC-DOS, *DataStar* or *ReportStar*.

Witech Corp.

763 Vallejo Way

Sacramento, CA 95818

(916) 441-7772

CIRCLE 771 ON READER SERVICE CARD

SOFTWARE

Canadian Payroll System

A payroll program supporting up to nine user-definable deductions and four rate categories per individual employee. Reports issued by the software are monthly, range-of-dates, or year-end payroll summaries, input registers, two versions of employee lists, and check-stubs. Twenty-week U.I.C. eligibility tables are maintained for each employee, along with all relevant year-to-date totals. Records of employment (separation slips) and T4 slips are printed directly on government-supplied forms.

The payroll accounting program provides password security at several levels, including password protection of all salaried employee records. Salaried employee files have provisions to enable the user to issue cash advances, bonuses, and lump sum payments.

Payroll can be calculated concurrently for hourly, salaried, commissioned, and piecework-paid employees. (List Price: \$795 Canadian; \$635 U.S.)

Requires: 64K, two disk drives, PC-DOS or CP/M-86.

Arctic Data Corp.
1839 First Ave.
Prince George, BC
Canada, V2L 2Y8
(604) 562-5240

CIRCLE 782 ON READER
SERVICE CARD

DataFile

A database management program allowing data files with as many as 45 items per record. *DataFile* allows the user to assign up to ten key phrases to the function keys to simplify data entry. Records can be selected through up to five selection criteria. Sorting of selected records can be as many as three levels deep.

The user may specify up to nine report formats for each file, and reserve up to 512 characters for comments or other textual material. Menu options eliminate the need to learn complex commands, and the program incorporates sub-menus at the end of each major pro-

gram component to eliminate the need to return to the master menu after each function.

(List Price: \$225)

Requires: 128K, two 320K drives, PC-DOS, monitor, printer.

MBS Software

12729 N.E. Hassalo St.
Portland, OR 97230
(503) 256-0130

CIRCLE 775 ON READER
SERVICE CARD

The Tax Depletion Program

An oil and gas tax program which provides complete depletion calculation on a property-by-property basis.

This *MCM Tax Series* release includes features such

as cost and statutory depletion; 50% net income limitation calculations and allocation of the 65% limitation to properties; net income from oil and gas revenues, preference IDC, and allocation of overhead to properties; sorting of information required for state tax calculations; and the preparation of schedules which can be attached to a user's Federal income tax returns.

(List Price: \$1,750)

Requires: 128K, two 320K drives, PC-DOS.

MCM Systems, Inc.
2706 Richmond, #100
Houston, TX 77098
(713) 522-1700

CIRCLE 773 ON READER
SERVICE CARD



Canadian Payroll Systems, Arctic Data

We have developed an 8" diskette system called "THE FILE CONNECTION" that can be used to exchange source, data, and word processing files between the IBM PC and hundreds of other computer systems. We use a modified IBM diskette controller card to attach either 1 or 2 external 8" drives to the IBM PC. Our utilities work with all IBM models including the 3741, 5120, S/1, S/34, S/38, S/370, 43XX, and Displaywriter. Other systems include DEC, NCR, TRS80, Univac, Burroughs, Honeywell, and CP/M.

Our programs provide automatic format identification and accept diskettes with 1 or 2 sides, single or double density, and 128, 256, 512, or 1024 bytes/sector. Source file reformatting and ASCII-EBCDIC conversion is included. The diskette can also be used as a 1.2 Mbyte or 320 Kbyte DOS drive.

The complete system price including TANDON B48-2, enclosure, cable, and basic utility programs is \$1295 for one drive and \$1995 for two drives. For users who want to use their own drives, the basic utility programs and documentation are available for \$695. Payment is by check or COD with delivery within 10 days.

CIRCLE 244 ON READER SERVICE CARD



"THE FILE CONNECTION" 8" DISKETTE SYSTEM

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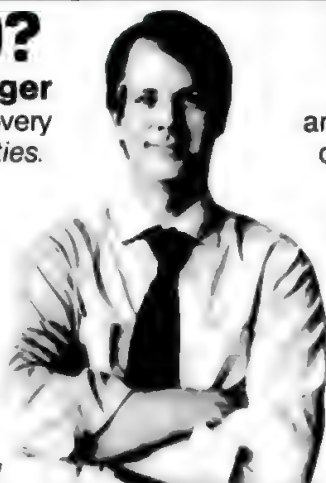
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CIRCLE 346 ON READER SERVICE CARD

HOW TO USE COMPUTERS TO TEACH MATH!

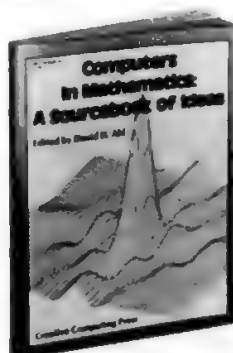
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STORK 1.0 is written in dBASE II, and data files are standard ASCII text, providing compatibility with other software. Files may also be downloaded from mainframe systems directly into the program's files.
(List Price: \$6,000 for license, plus dBASE II license cost)

Requires: 128K, two 320K drives, PC-DOS or CP/M-86, dBASE II.
The Baily Co.
36150 Pauba Rd.
Temecula, CA 92390
(714) 676-2273

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A wine and beverage inventory program for restaurants, bars, and hotels. The program can maintain inventory for up to 40 locations. It can print administrative reports giving descriptive information, usage and reor-

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In addition, the program can print wine lists which are suitable for presentation to the customer.

(List Price: \$750, for single-user; \$1,500 for multi-user system)

Requires: 64K, two 320K drives, PC-DOS, monitor, 132-col. printer.
Jupiter Island Corp.
1900 Powell St., #1135
Emeryville, CA 94608
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A series of applications templates/programs for the *Lotus 1-2-3* spreadsheet program. Initial releases of *PRO WORKS* software include:

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providing an array of business statements and balance sheet forecasts, automatically generating cash flow forecasts and financial changes from a base year.
(List Price: \$100 each program)

Requires: 256K, two 320K drives, PC-DOS 1.1, *Lotus 1-2-3* version 1A.

Reston Publishing Co. Inc.
11480 Sunset Hills Rd.
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(List Price: \$200-\$4,000 per module, depending upon module)

Requires: 128K, Hard Disk, PC-DOS 2.0, 132-col. printer.

Bristol Information Systems, Inc.
84 N. Main St.
Fall River, MA 02720
(617) 679-1051

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Rainbow Writer Color Text Formatter

A utility program for printing color text and graphics on users' systems equipped with Prism Printers. *Color Text Formatter* can be used with any word processor using ASCII format files. Over 60 commands are provided for the following capabilities: color text, with or without graphics; true proportional spacing; setting margins; pagination; forward page referencing; wordwrap; mail merge; table of contents with page numbers; index with page numbers; variable character size and spacing; variable form length; multiple copies; conditional processing; page headers and footers; and other features. All values are expressed in inches.
(List Price: \$149)

Requires: 64K, two disk drives, PC-DOS, IDS Prism printer.
Application Techniques, Inc.
80 Townsend St.
Pepperell, MA 01463
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ACCESSORIES



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ACCESSORIES

Micro-UPS, GSU 3056

A new version of the manufacturer's 500-watt rated Uninterruptible Power Supply (UPS). The on-line device provides continual voltage regulation and noise elimination as well as battery reserve power during complete power outages. The model GSU 3056 unit incorporates a 10-minute battery, or can be used with external 48-volt batteries for periods up to several days.

The UPS utilizes power MOSFETs switching at 70MHz to produce a pure power output sine wave capable of maintaining 120 volts output value even when powering non-linear loads. The device includes

features such as line synchronization with slow skew acquisition, table or rack-mounted design, and an optional static switch.

(List Price: \$1,450)

Gould, Inc.

2727 Kurtz St.

San Diego, CA 92110

(619) 291-4211

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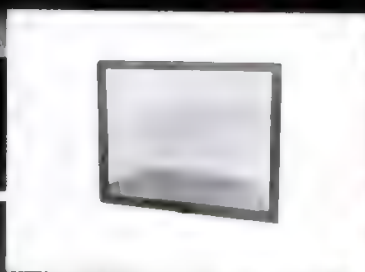
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ACCESSORIES/PUBLICATIONS

TouchBase 1

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(800) 328-0223

(612) 430-2060

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Keyboard Companion

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Costa Mesa, CA 92627

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PUBLICATIONS

Computer Bridge

A guide to Bridge software. Written by Thomas Throop, the book critiques computer bridge programs such as *Bridge Challenger*, *Bridge 2.0*, *Goren Bridgemaster* and *Bridge Tutor*. These and other programs are evaluated, and advice and tips are provided for those

contemplating Bridge software development. In addition, trends in dedicated electronic Bridge games and experiments in cable-delivered teletext Bridge are analyzed. Sample hands generated by Bridge software illustrate bidding and playing options.

(List Price: \$9.95)

The Hayden Book Co., Inc.

50 Essex St.

Rochelle Park, NJ 07662

(201) 368-2202

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Absolute Reference

A monthly journal for users of the Lotus 1-2-3 spreadsheet program. *Absolute Reference* offers its subscribers regular columns on the features of the spreadsheet software (including database management, graphics, and macros), and guest columns by 1-2-3 experts. Other regular features include examples of business applications for 1-2-3; helpful tips on using the software; reviews of products being marketed to 1-2-3 users, such as training courses, templates, and books; as well as general articles of interest to users of the Lotus software. (Annual subscription; \$60)

Que Corp.

7960 Castleway Dr.

Indianapolis, IN 46250

(317) 842-7162

CIRCLE 763 ON READER
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PUBLICATIONS

USMI: Market Directory

A guide, in looseleaf form, to doing business with software producers and publishers. The book provides profiles of over 500 current publishers, ranging from large software firms to small entrepreneurs. It is designed to be updated six times a year, with revised and new data to be added to each looseleaf.

USMI is an acronym for Universal Software Market Identifier, a software registry system used in categorizing publishers and their products. Included in the *USMI: Market Directory* are the following kinds of information: descriptions of companies and their product lines; technical support available; retail account procedures; point-of-sale support provided; warranty information; as well as contact names and phone numbers for each company listed.

Companies listed in the guide are indexed six ways: by key subject area (such as education, financial analysis, etc.); by computer/operating system for which the software is intended; by company; by geographic location; and by USMI registration number.

(List Price: \$195, including updates)
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40 Cedar St.

Dobbs Ferry, NY 10522
(914) 693-8100

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Computer Products Catalog

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32 BASIC Programs

A book, by authors Tom Rugg and Phil Feldman, providing code for 32 tested, ready-to-run BASIC programs. The programs can either be entered into a user's system manually, or the user may choose to purchase the accompanying diskette with all software ready for immediate use.

The book, titled *More Than 32 BASIC Programs For The IBM Personal Computer*, includes guidelines for making modifications and alterations to the programs as required, and

the software allows a user to make more extensive changes at will. Contents of the book include Applications Programs (for home and/or work); Educational Programs; Graphics Display Programs; Mathematics Programs; and Miscellaneous Programs, covering a variety of programs providing useful functions.

(Book alone: 350 pgs., \$19.95; with diskette \$34.95)

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Software Consultants Directory

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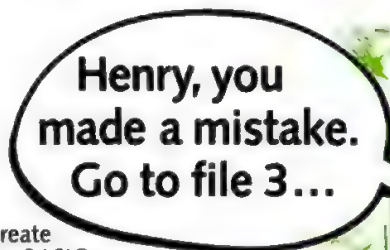
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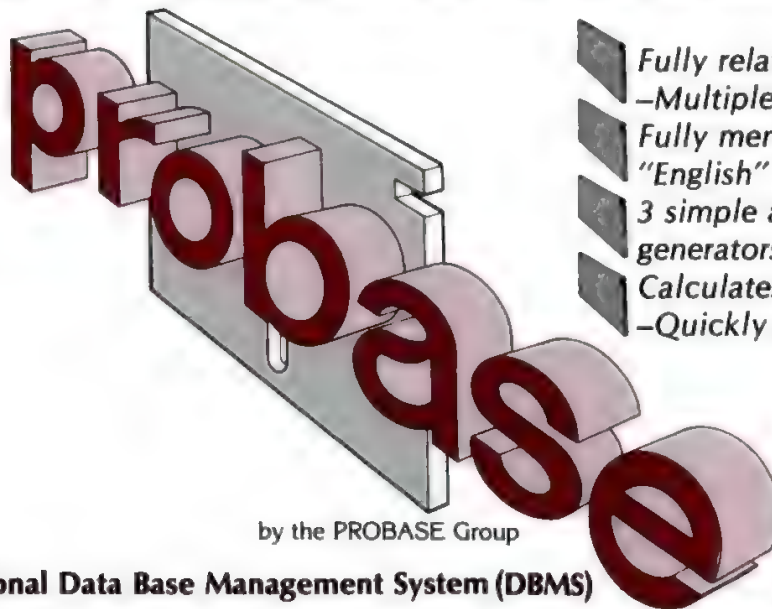
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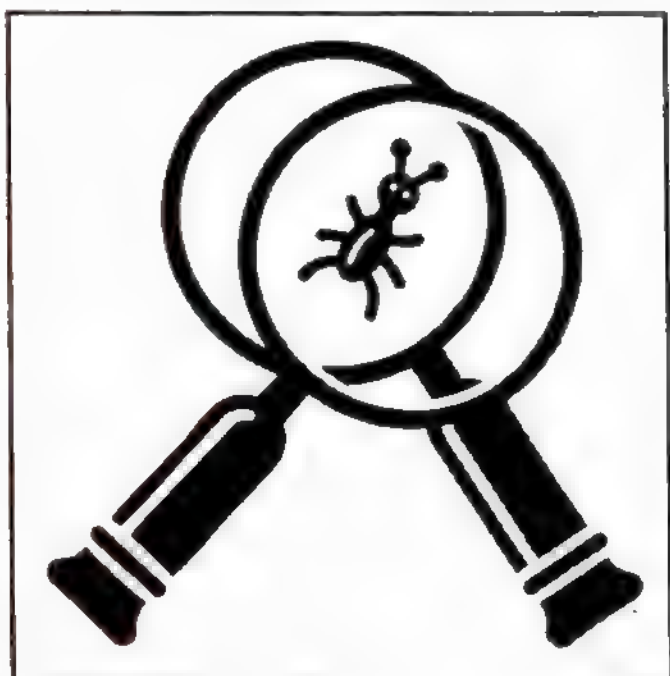
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Sounding Off

Here are some neat little programs:

The first finds out how much memory your PC has:

```
100 REM-memory checker
110 SCREEN 0:KEY OFF
:COLOR 2, 0, 0:CLS
120 DEF SEG=&H40
130 X=PEEK(&H13)+
256*PEEK(&H14)
140 LOCATE 11, 28
150 PRINT "You have";
:COLOR 23
160 PRINT X; "K";:COLOR 2
:PRINT " of memory"
```

The second lets you create interesting sounds:

```
100 OUT 67, 182
110 OUT 66, 255
```

```
120 OUT 66, 127
```

```
130 OUT 97, (INP (97) OR 3)
```

Line 100 sets up the speaker for lines 110 and 120. Lines 110 and 120 in turn, send the low and high bytes, respectively, that control the sound mode. The integer in this case is $(127*256)+255$, or 32767. Line 130 turns on the speaker. Changing the values OUTed in lines 110 and 120 will change the sound produced.

The sound in the above example is very much like the motor drone used in Micro-Soft's *Flight Simulator*, and will continue even after the program has stopped running. There are many ways to turn it off. You could, for instance, add a line:

```
140 OUT 97, (INP(97) and 252) )
```

If you turned off the sound this way you might want to add a delay loop:

```
135 FOR A=1 TO 1000:NEXT
```

to give the sound a chance to play before you turned it off. And, of course, you could stop the sound by hitting CTRL+BREAK.

Adam Barr

Mount Royal, Canada

By playing with the value in lines 110 and 120 you can create some truly unusual noises, especially if you replace the 255 and 127 with variables in a FOR...NEXT loop.

In addition, you can do certain things with this technique that you just can't do in

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USER-TO-USER

BASIC. For instance, you can create a lower sound than the bottom BASIC bass note by running this short program:

```
100 REM—low sound
110 OUT 66,0:OUT 66,0
120 OUT 97,(INP(97) or 3)
130 CLS:LOCATE 11,23
140 PRINT "Hit any key to
stop this low sound"
150 I$=INKEY$:IF I$=""
THEN 150 ELSE SOUND 37,0
```

Or you can make a game laser-zap sound with:

```
100 REM—zap sound
110 FOR A=0 TO 20
120 OUT 66,A:OUT 66,A
130 OUT 97,(INP(97) or 3)
140 NEXT A
150 SOUND 37,0
```

Color Tricks

Here's an easy way to spice up any medium resolution graphics and/or text. All you have to do is add this little routine to a program after you draw an image:

```
10000 COLOR,0
10100 COLOR,1
10200 GOTO 10000
```

That's it. Unfortunately, this "rolling colors" effect won't work if you screw up the speed at which it executes, by putting everything on one line, using a FOR...NEXT loop, or adding any other tricks.

You can also get the same effect in a medium resolution background by adding this routine:

```
20000 OUT 985,W:OUT 985,X
20100 OUT 985,Y:OUT 985,Z
20200 GOTO 20000
```

where W,X,Y, and Z are integers between 0 and 15. For this routine you also have to put two OUT statements on one line, otherwise the background will flicker annoyingly.

In color text mode you can play with the border the same way with this routine:

```
10000 COLOR,,X
10100 COLOR,,Y
10200 GOTO 10000
```

where X and Y are integers between 0 and 15. Again, don't add anything or the effect will be spoiled.

Chuck Corby
Buffalo, NY

These routines may look trivial, but they actually do interesting things onscreen. We've put them into small programs (Figures 1, 2, and 3) to better illustrate how they work. You can incorporate the basic routines into your own programs to enhance your static screens.

Printer Test

A very nice feature in any program is to first check to see if the printer is on line before sending anything out to it, preventing a possible program crash. You can do this in BASIC by checking the status of port #957. If it returns a decimal 233 the printer is on line; anything else means it's not. You can insert the following lines into your BASIC programs to tell you whether the printer is actually on-line:

```
1000 REM—printer test
110 IF INP(957)=233 THEN
150
120 PRINT "Your printer is
not on-line."
130 PRINT "Fix, then hit any
key."
140 I$=INKEY$:IF I$="" THEN
140 ELSE 110
150 REM — the program
continues here
160 BEEP:REM — if beeps,
printer is on-line
```

Bert Sirkin
Enfield, CT

This works well, and is far less trouble than using ON ERROR...GOTO trapping. The program won't proceed unless the printer is turned on and is on-line.

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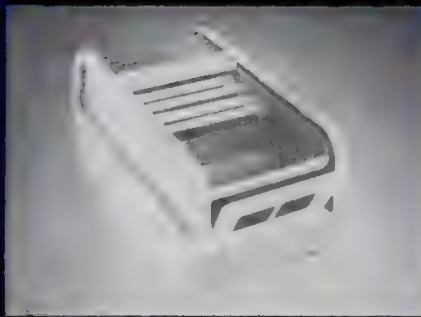
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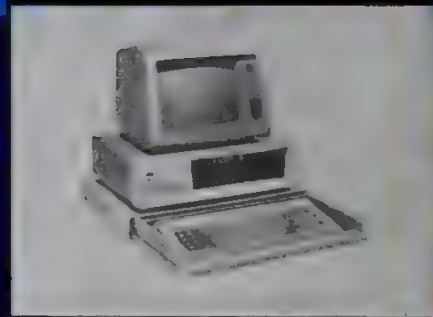
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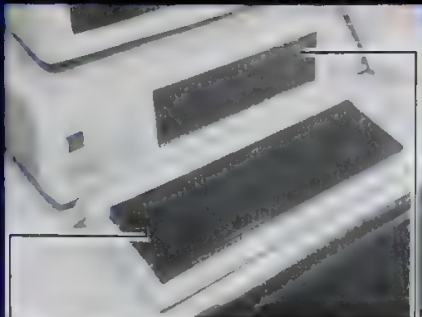
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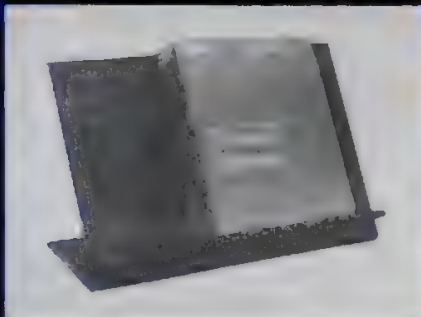
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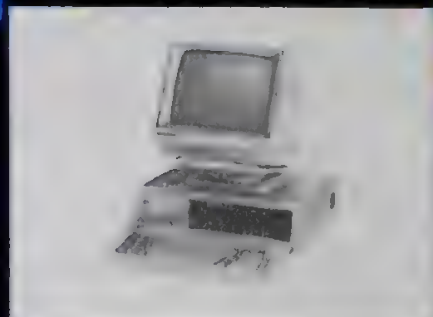
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Furthermore, all programs that create .COM or BSAVE'd executable code from decimal or hex data must be accompanied by the source code in assembly language. This, too, will reduce errors and will be instructive to readers of User-to-User. ■

```
100 ' rolling colors 1
110 ON KEY(1) GOSUB 190:KEY(1) ON
120 SCREEN 1,0:CLS
130 LOCATE 25,15:PRINT "Hit F1 to end";
140 CIRCLE (160,100),90,2
150 PAINT (160,100),1,2
160 COLOR ,0
170 COLOR ,1
180 GOTO 160
190 LOCATE 1,1:END
```

Figure 1: Rolling colors 1 (use BASICA only).

```
100 ' rolling colors 2
110 ON KEY(1) GOSUB 190:KEY(1) ON
120 SCREEN 1,0:CLS
130 CIRCLE (160,100),90,2
140 PAINT (160,100),1,2
150 LOCATE 25,15:PRINT "Hit F1 to end";
160 OUT 985,1:OUT 985,2
170 OUT 985,3:OUT 985,4
180 GOTO 160
190 LOCATE 1,1:END
```

Figure 2: Rolling colors 2 (use BASICA only).

```
100 ' rolling colors 3
110 SCREEN 0:WIDTH 80:COLOR 2,0,0:CLS
120 LOCATE 12,30,0:PRINT "Hit any key to start"
130 ON KEY(1) GOSUB 190:KEY(1) ON
140 IS=INKEY$:IF IS="" THEN 140
150 LOCATE 12,30:PRINT " Hit <F1> to stop "
160 COLOR ,,4
170 COLOR ,,5
180 GOTO 160
190 COLOR 2,0,0:CLS:GOTO 120
```

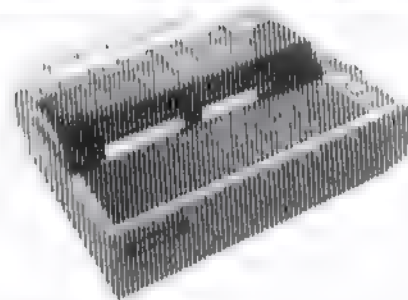
Figure 3: Rolling colors 3 (use BASICA only).

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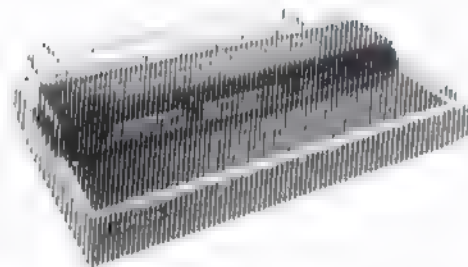
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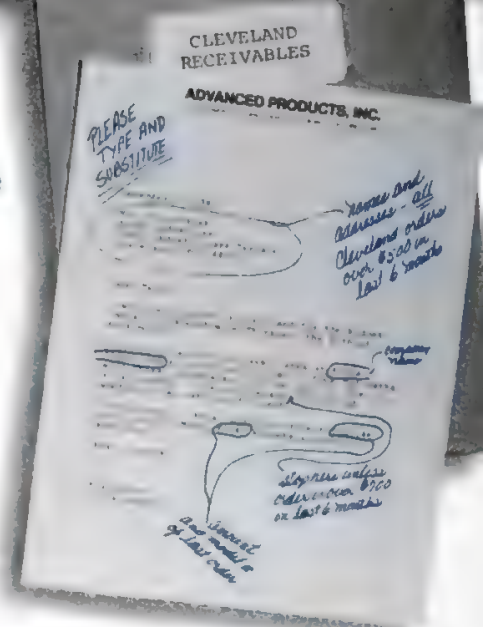
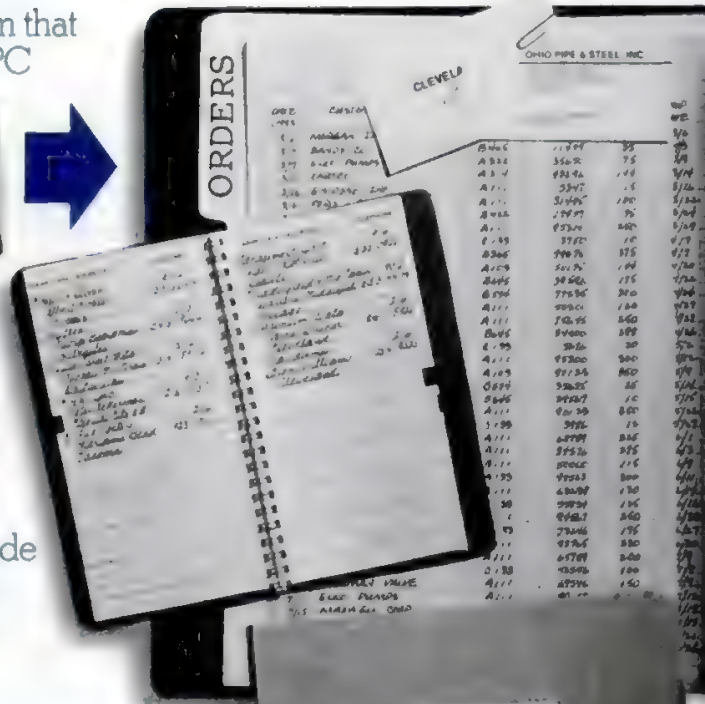
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CO	289-865-7773	TURLOCK, CA	05/14/83	295	67	B-645
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LY	501-025-5469	FT. SMITH, AR	05/26/83	39	96	C-133

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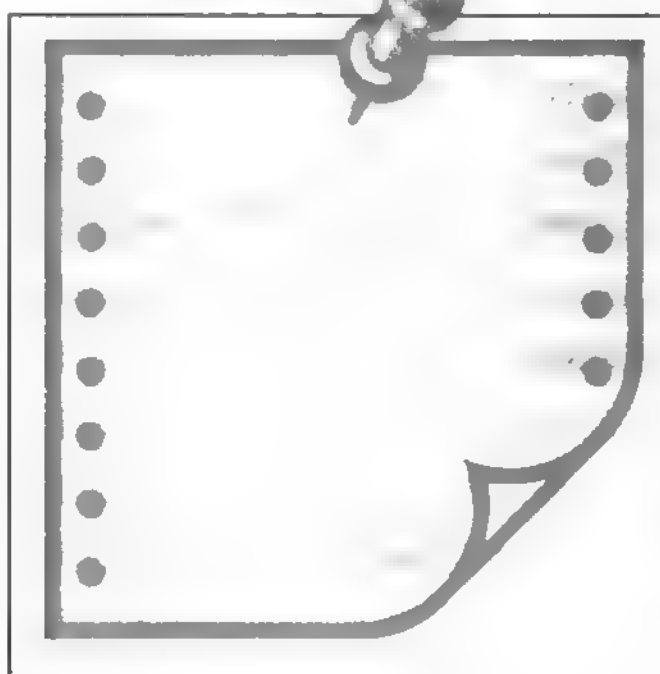
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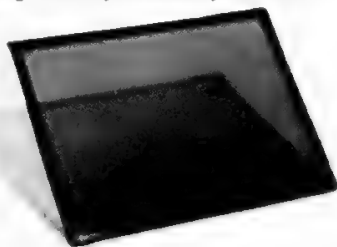
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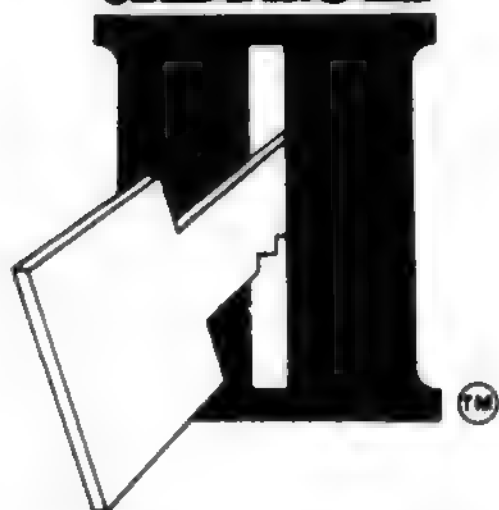
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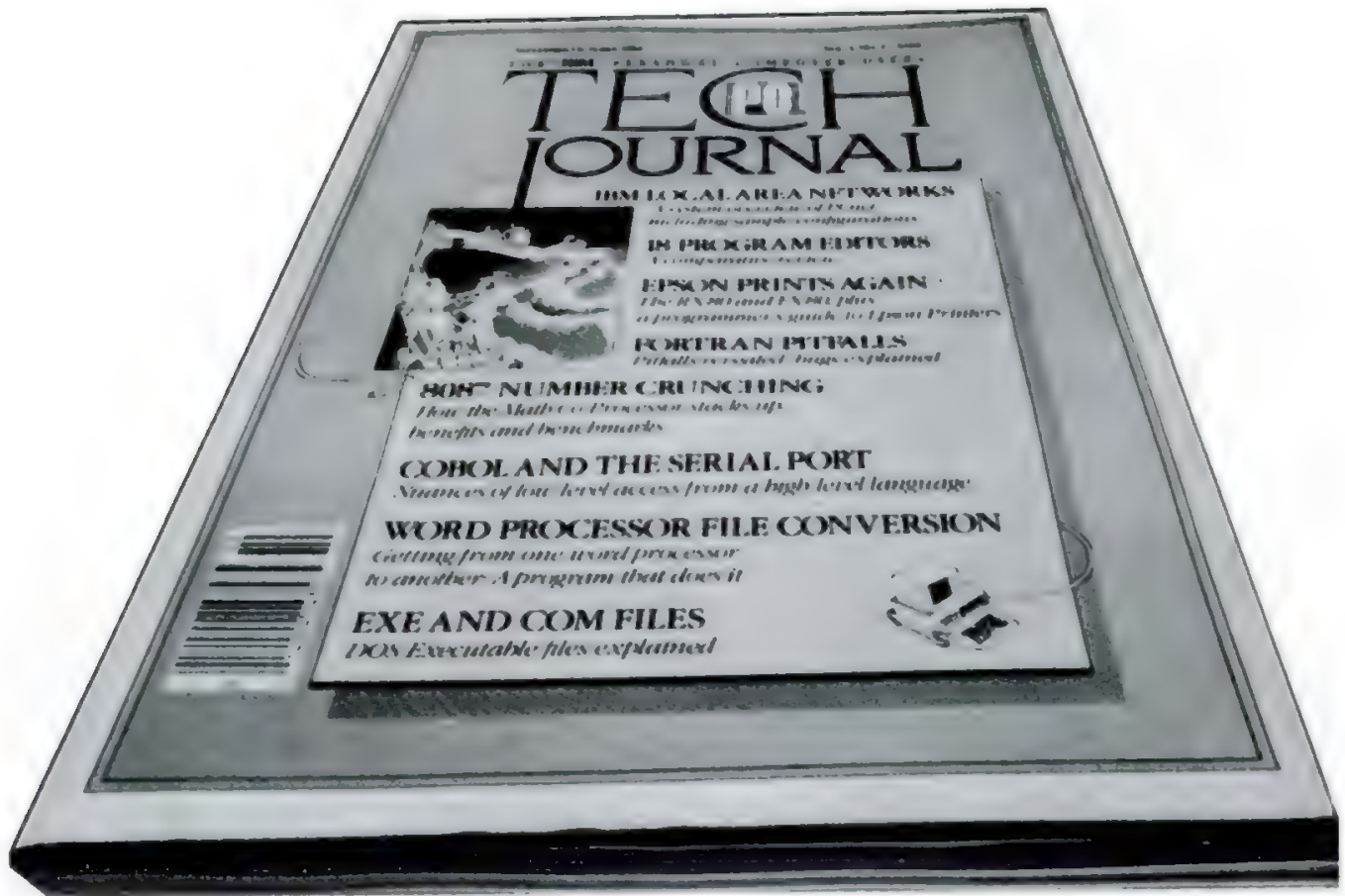
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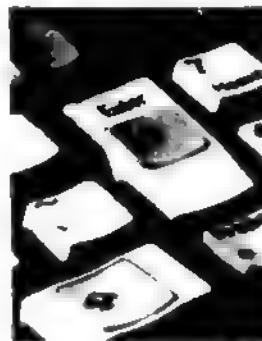
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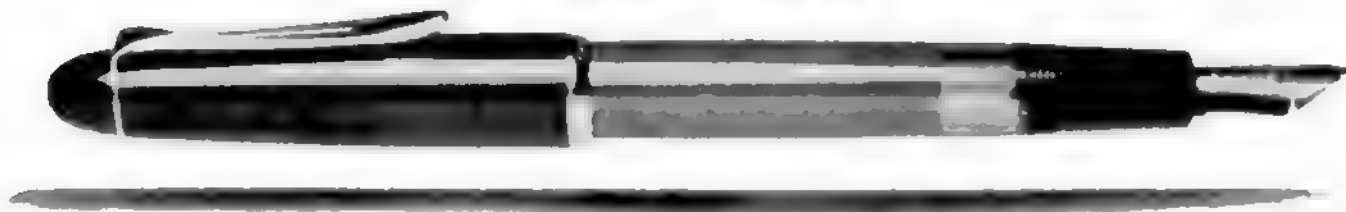
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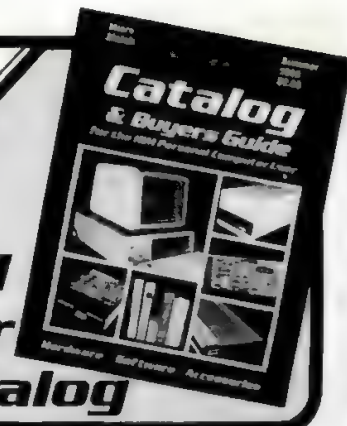
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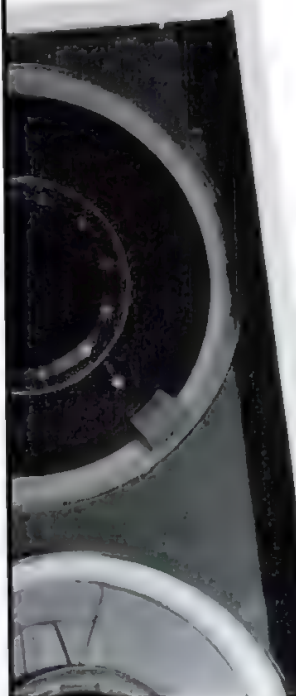
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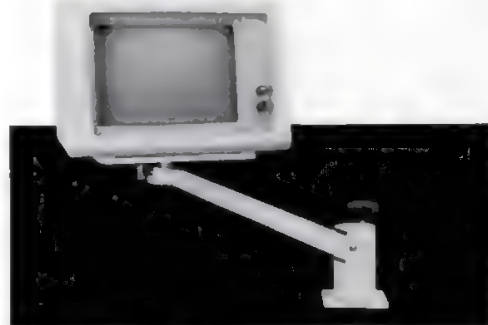
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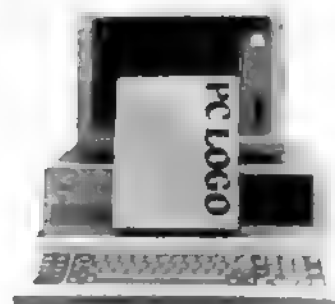
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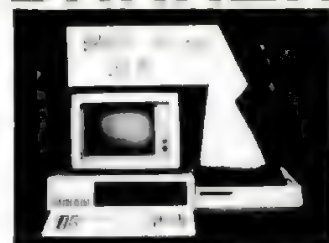


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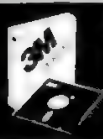


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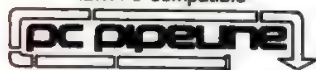
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PC Tutor



Counting the Bytes

Q: I would like to know precisely how much RAM storage the IBM PC is really capable of using. I have seen various numbers. The RAM board instruction manual I have indicates "more than 544K." One of your answers, "A Surfeit of Memory" in *PC*, Volume 2 Number 6, implied that problems develop because of overlays if memory is as large as 832K. The System Memory Map in the *Technical Reference Manual* shows 64K on the system board, a 192K maximum I/O channel, and 384K for future expansion. So how much memory really can be assigned to a RAM disk?

Michael D. Fabre

A: The *Technical Reference Manual* shows the right number—the maximum addressable memory you can insert into an IBM PC is 640K. The 64K PCs, however, do not support more than 544K

internally. When the 256K PC was introduced, at the same time as the XT, the EPROM BIOS was changed to accommodate an additional 96K. This change really only affected the way the memory switches are interpreted.

You can fit even more memory into the computer by using a bank switching arrangement. This method puts only 1 page of memory (which may be anything from 1K to 512K) on the bus at any time. By sending a byte to a port, you switch between the pages on the memory card. This is the way the Tall Tree Systems memory card works.

A final approach is to have a memory card that looks like a data port. You output the memory address to the port, and the port returns the value on the card at that address or writes a value to that address. This is how the SemiDisk Systems memory card works.

If you just want a larger RAM disk, either of these cards will let you support one, since the RAM disk can read the memory appropriately.

As for the megabyte-sized memory cards, check to make sure that a card uses bank switching (also called "paging"). Putting a plain memory card with a linearly addressed megabyte into the PC would overlap the video display memory and the BIOS and BASIC in ROM, causing dreadful results.

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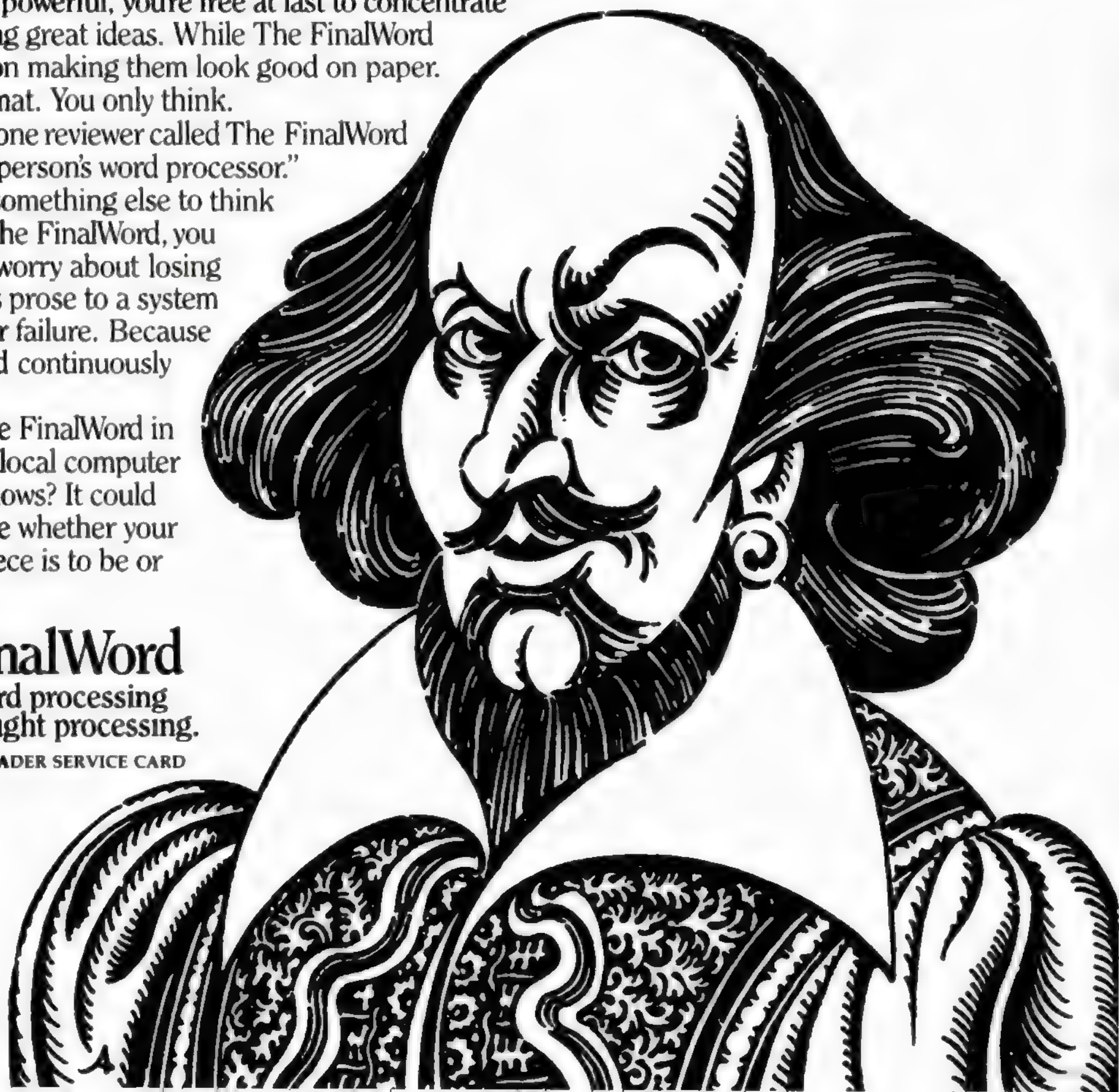
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PC TUTOR

arithmetic. For instance, I keyed in "16918855," divided this by 100, and wrote the result to disk. But when I read it back, the number is 169188.5625. Even if I hadn't divided by 100, the number comes back as 16918856!

Would you tell me what I have to do for the PC to keep numbers correct to the penny?

Don Catalini
Solon, Ohio

A: You are encountering a precision problem. According to the BASIC 2.0 manual (page 3-11), single-precision (7 digit) real numbers are accurate only up to 6 digits. Since arithmetic operations may introduce errors in the least significant digit, you need a numerical precision of at least 9 digits to preserve the 8-digit number you gave.

Since double-precision real numbers have 55 bits for the mantissa, you can use this format to represent integers up to 2⁵⁶—about 16 digits. (Refer to the BASIC 2.0 manual, page C-15, where the real number format is described.)

The solution to your problem is to store the number as double precision. Examine the following BASIC session (underlined portions are what you enter):

```
A=16918855
OK
PRINT A-169100000
8856
A#=16918855#
OK
PRINT A#-169100000#
8855
```

In BASIC, following a number or variable with the pound sign (#) will indicate that the number should be stored as double precision. You'd think BASIC would realize that your 8-digit number cannot be stored adequately as a single-precision real number, and would adjust accordingly. However, BASIC works by assuming single precision, unless you use a DEF command or the # sign.

Going for a New Record

Q: I have a problem defining fields for random disk files in BASIC. It is my understanding that the maximum total length of any field statement is 256 bytes. This restriction, along with strings being limited to no more than 255 bytes, makes it extremely difficult to define large blocked records.

My data files contain 512-byte, full-sector records with more than 50 fields per record. Although I can redefine the records using multiple-field-definition statements, when I try to block ten of these records, the padding needed for records 1-9 uses up all the available 256 bytes. Is there any way to solve this using BASIC?

Robert Svenson
Barrington, Illinois

A: You should be happy to find that there is no real limit to the size of a random record. You can easily define a FIELD statement that gives a total record size of more than 512 bytes. The trick here lies in informing BASIC sufficiently ahead of the time that you plan on using a larger record size.

When you load BASIC, it allocates a certain amount of storage to a disk buffer. Your record size may not exceed the original allocated buffer size. To allow when you call BASIC. For example:

```
BASICA /S:20000
```

will define a storage buffer of 2,000 characters.

Beyond the Horizontal

Q: I recently installed a NEC RGB monitor on my IBM PC. On this monitor, the cursor went too far to the left edge of the screen. Adjusting the horizontal centering control inside the monitor helped, but did not completely solve the problem. Why does this occur? Is there a permanent solution?

Gene P. Ahl
Rochester, New York

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PC TUTOR

A: The cursor moving too far to the left is a result of differences between displays. Your display works by having an electron beam move horizontally from left to right on the screen. When it reaches the right-hand edge, it is blanked out before it is pulled back to the left by a synchronization (synch) pulse. Monitors differ on several points: how long after the synch pulse before the beam reaches the left side, how far to the left is the left-hand edge, and how long after that until the beam is in position for display.

The NEC display expects a longer period of time between the synch pulse and the first character than the IBM color/graphics card normally supplies. All is not lost. You can change the time delay with the PC-DOS MODE program by typing one of these lines:

A>MODE 80,R,T

A>MODE 40,R,T

This program will generate a test pattern and let you increase the time delay, which has the effect of moving the whole picture to the left. Increase the time delay until the display is satisfactory. This is good until you reboot the computer or turn it off.

If you want your display to come up with 80 columns shifted 2 characters to the right, you can include this line in your AUTOEXEC.BAT file:

MODE 80,R,2

If you do this, make sure the MODE program is included on your boot disk.

Moving Upward with PC-DOS

Q: For word processing I use EasyWriter 1.1 with PC-DOS 1.0 copied onto it. I want to update to PC-DOS 1.1, but I've heard that there may be problems. IBM's DOS 1.1 manual warns: "the DOS 1.10 commands should never be executed when you are running DOS 1.00, and the DOS 1.00 commands should never be executed under DOS 1.10."

Does this mean that an EasyWriter storage diskette that had been formatted

by PC-DOS 1.0 should not be used if I am word processing with an EasyWriter program disk that has PC-DOS 1.1 copied to it? Or vice versa: should EasyWriter with PC-DOS 1.0 copied to it not be used on a storage diskette formatted by PC-DOS 1.1?

A second question: how would I go about eliminating PC-DOS 1.0 from my EasyWriter disk and replacing it with PC-DOS 1.1?

Nicholas Rinaldi
Fairfield, Connecticut

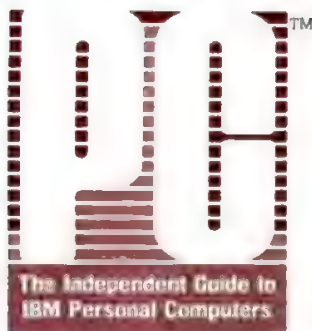
A: When the DOS manual refers to "commands" in that sentence, it really means "programs." If you are running PC-DOS 1.1 and wish to perform CHKDSK, for example, make sure you use the CHKDSK.COM program supplied with PC-DOS 1.1, not 1.0.

*Here's how to replace PC-DOS 1.0 with DOS 1.1 on your disks. Boot up the computer using the PC-DOS 1.1 disk—make sure you use the 1.1 utility programs. Leave the PC-DOS 1.1 disk in drive A:. Then, do these two things to each old diskette you own, which you'll put in drive B:. First, run a CHKDSK on the old diskette. If this shows the two hidden system files are on it, transfer the new system files by entering **SYS B:** after the A> prompt. Then, get a directory list of your old disk. Replace any PC-DOS programs on the old disk with their new 1.1 versions. For example:*

A>COPY CHKDSK.COM B:

will replace the CHKDSK program.

Contrary to some reports, all versions of PC-DOS are upward compatible. PC-DOS 1.1 can read and create 1.0 disks, and PC-DOS 2.0 can read and create PC-DOS 1.1 and 1.0 disks. You should be careful with EasyWriter, though. One of the earlier versions of this program systematically ruins double-sided storage disks. This problem is not subtle; you should easily be able to detect whether your version of EasyWriter suffers from this ailment.



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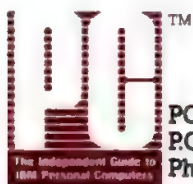
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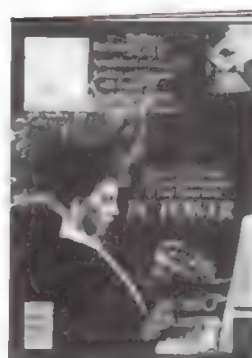


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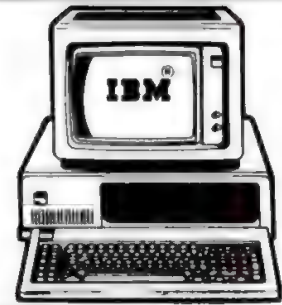
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LANGUAGES

find the sales revenue and advertising expenditure figures are expressed in millions of dollars; the price per unit is given in dollars. Using descriptive names for each variable (see Figure 1), you enter

APL can be used to solve meaningful problems quickly and easily.

these values into APL vectors.

These variables are now in an APL workspace where you can use them. Note the features of APL apparent in the statements in Figure 1. A single statement can specify an entire vector. Blanks separate individual data elements, but commas could also be used. Also, numbers with and without decimal points may appear together in a single specification.

You expect it will be convenient to have these variables collected into one data matrix with ten rows and three columns. To do this, you enter this line:

```
D←N3 10P ADVERTISING, PRICE, SALES
```

You now display the contents of data matrix D to make sure it was specified correctly.

D		
1	5	10
1.1	5.5	10
1	4.7	11
1.4	5	12
1.2	5.3	12
1.3	5.5	13
1.6	6	14
1.5	5.8	16
1.1	4	15
1.2	4.2	14

The first calculations you perform on this data matrix find averages for the values in each column. You enter this APL statement directly into execution mode:

```
(+/D)÷1↑PD
```

The expression to the right of the division sign determines the number of rows in data matrix D. The sums of the columns (calculated by the expression within the parentheses) are divided by the number of

rows. Thus, one APL statement calculates all three averages. The results are displayed immediately:

```
1.24 5.1 12.7
```

APL allowed you to calculate the average for all columns without writing a looping procedure, as BASIC would require. In most situations, APL can handle calculations on arrays directly.

In the next step of your analysis, you will examine the degree of association between the variables by calculating the correlation coefficients. The correlation coefficient for any two variables is defined as their covariance divided by the product of their respective standard deviations. You calculate the degree of association for the sales and advertising variables by entering these statements:

```
AVES←(+/B)÷PB←SALES
AVEA←(+/A)÷PA←ADVERTISING
VARB←(+/ (B-AVES)²)÷(PB)-1
VARA←(+/ (A-AVEA)²)÷(PA)-1
COV←(+/ (B-AVES)×(A-AVEA))÷(PB)-1
COR←COV÷(VARB×VARA)⁰.5
```

```
COR
```

The result is:

```
0.60654063
```

APL expressions are usually near-literal translations of standard formulas, which is a distinct advantage. Writing the above APL statements allowed you to satisfactorily perform a one-shot calculation, but you suspect that your boss will want to see more correlations, which you'll have to calculate on short notice. To provide for this, you decide to revise the above expressions to define a general APL function—to be named CM—that will calculate the correlation matrix for any data matrix called M:

```
⍷Z←CM M ;K;MB;X
[1] a Correlation Matrix for M
[2] M←((NM)÷.×M)-(MB÷.×MB÷+/M)÷1↑PM
[3] X←M(M×(1K))-.(K÷1↑PM)⁰.5
[4] Z←X÷.×M÷.×X
```

APL's array-handling capabilities al-

LANGUAGES

```
ADVERTISING←1 1.1 1 1.4 1.2 1.3 1.6 1.5 1.1 1.2
PRICE←5 5.5 4.7 5 5.3 5.5 6 5.8 4 4.2
SALES←10 10 11 12 12 13 14 16 15 14
```

Figure 1: Unit price, in dollars, and advertising expenditures and sales revenue, in millions of dollars, are entered as APL vectors with descriptive names.

```
CM D
1          0.62424393  0.60654063
0.62424393  1          -0.02473805
0.60654063 -0.02473805  1
```

Figure 2: Correlation coefficient matrix values for D. The diagonal row of ones indicates the correlation of the variables with themselves.

lowed you to produce a correlation matrix function in these few lines of executable

APL's array-handling capabilities allowed you to produce a correlation matrix function in three lines of executable code.

code. Line [1] is only a comment. Line [2] calculates covariances for each column of matrix M. Line [3] calculates standard deviations, and line [4] divides covariances by standard deviations.

These are the textual definitions of some of the APL functions you employed to create the new correlation matrix func-

tion, CM:

```
⊖      matrix transpose
+.*    matrix multiplication
∘.*    outer product (multiplication)
∘.=    outer product (equality)
⊖      matrix inversion
```

Now that you have defined the CM function, use it to calculate the correlation matrix for data matrix D. The output is shown in Figure 2. The values in this correlation matrix appear in the same order as the variables that were listed when you defined data matrix D. For example, the correlation between advertising and sales (calculated separately in the earlier example) can be found in the first column, third row.

In an upcoming issue of *PC Magazine* you'll discover how to complete your boss' assignment by using APL to perform multiple linear regression calculations and then to plot the results. ■

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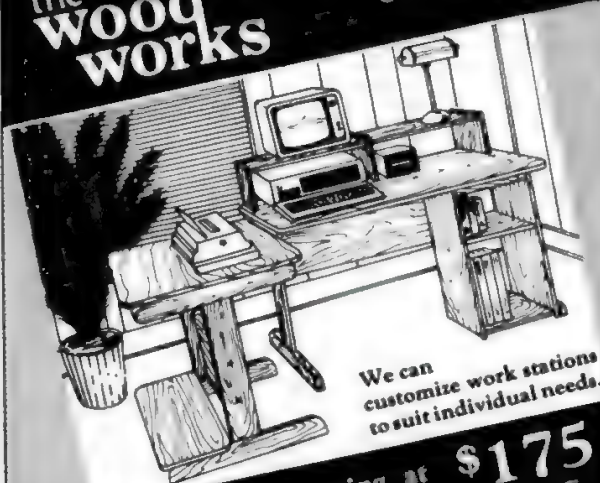
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Signing On To A SIG

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The gold rush is on. Log on to the IBM PC Special Interest Group (SIG) on CompuServe, and you'll find tips, advice, essays, and user-contributed software to appeal to any IBM PC owner.

Subscribers to the CompuServe Information Service (CIS) will find the IBM PC SIG offers too many features to catalog here, but a summary of some of the most outstanding options may give you an idea of the riches available. To begin with, as in all CIS SIGs, there is a message exchange that allows SIG members to conduct an ongoing dialogue with one another about PC hardware, software, applications, peripherals, problems, tips, tricks, and anything else they're interested in. The messages are publicly available, so anyone can "listen in" on, say, a discussion about the relative merits of a particular modem or software package. If you are a new PC owner who has a question or a problem, scanning the messages on the SIG or posting one yourself is an excellent way to find a solution.

The SIG also provides up-to-the-minute technical information through its Rapid Deployment Force. For example, within 24 hours of the PCjr announcement last November 1, at a time when most people were rummaging through stories in the general media for some shred of hard data about the new system, no fewer than four files on the PCjr had already appeared in



the SIG. No one knows where the information came from, but it was far more detailed and complete than the handouts available at local IBM Product Centers. The files read like official (possibly internal) IBM documents.

The SIG contains listings of the privately owned-and-operated Bulletin Board Systems (BBS) around the country that specialize in the PC, as well as a list of non-IBM BBSs, sometimes called Public Access Message Systems (PAMS). You can scan a directory of SIG members by name, location, personal interests, and CIS account number. There's even a section containing the specializations, résumés, and profiles of SIG members.

The IBM PC SIG's conferencing facility takes advantage of CompuServe's unique CB function to permit any number

of users to communicate in real time. The effect is similar to attending a meeting; you "listen" to the comments of various individuals and occasionally interject a comment or a question of your own. The best time to tune in is on Sundays, when the SIG holds its regular weekly real-time conference, but any group of members may use this feature at any time.

Sometimes this confab feature is set up as an open forum where anyone can throw out a question to the electronically assembled multitude, and sometimes a guest presents an "electronic lecture." One recent guest, for example, was Jeff Garbers, head of UserView, an Atlanta-based software firm. Mr. Garbers was one of the developers of Microstuff's best-selling program, *CrossTalk*. (Transcripts of this and most other conferences are available in the XA0 SIG database, a feature I'll explain in next issue's column.)

Perhaps most intriguing of all, however, is the treasure trove of free, public domain software that the SIG makes available. More than 200 programs—in everything from BASIC to assembler to Pascal to C, representing thousands of programming hours—are yours for the asking. These include games, utilities, DOS enhancements, text editors, print spoolers, patches for commercial software, graphics, music programs, and nearly any other category you can name.

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On-line electronic special interest groups form a new medium created to serve entirely new needs.

needs. How else could so many computer owners share their collective experience and knowledge with so many other computer owners, regardless of geographic location? On CIS today, nearly 20 different special interest groups cover everything from Pascal and the p-System to CP/M and most major brands of hardware. And CompuServe has created the software that makes all of this possible.

Getting Started

Getting the most out of the PC SIG takes a bit of work. The manual that comes with your CompuServe Starter Kit contains only one sentence about the system's groups and clubs. The Radio Shack Universal Sign-Up Kit, tells you even less. That's unfortunate because CompuServe SIGs are run under special software that supports a range of commands and features different from those found in the main CIS system. Without the correct documentation, you could enter the IBM PC SIG and never realize that the group's databases and free software collections were only a command away. Without being told, you might never even know they exist.

Consequently, the first step in preparing to use the SIG is to order the supplemental manual that will tell you how CIS SIGs work. First, select the User Informa-

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Only one small caveat applies. The manual ordering section of CIS automatically charges your credit card (MasterCard or Visa), but you must have already validated your subscription and entered your credit card number and billing information. Thus, if you are still using the free access time that was included in your start-up kit, you should answer Yes to the prompt, "Do you wish to sign up at this time?" The system will take you through the necessary electronic paperwork. After waiting 10 days for credit confirmation, you'll be able to order any manuals you need.

Now that you know about some of the features offered by CompuServe's IBM PC SIG, you'll need to find out more about accessing and using them. In the next issue of *PC*, I'll look at the actual procedures involved in mining the ore contained in this information deposit.

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Subscription packages may also be available at Radio Shack computer stores as the Universal Sign-Up Kit. At last check, this kit also included a subscription to the Dow Jones News/Retrieval Service. The package costs \$20 and includes 1 free hour on both systems. Unfortunately, it offers little documentation.

Each time you sign on using your free time, CompuServe will ask whether you want to sign up to continue your account. You should do this immediately since you will not be able to send mail or order manuals until your account and credit information have been verified. Simply follow the prompts and the system walks you through the electronic paperwork. (Be sure to have your credit card handy.) A new password will be mailed to you within 10 days. Upon its receipt you'll be a CompuServe Information Services subscriber entitled to the rights and privileges that it entails. ■

Alfred Glossbrenner is the author of The Complete Handbook of Personal Computer Communications and How to Buy Software, both published by St. Martin's Press. He can be reached at TCS772 on The Source and at 70065,745 on CompuServe.

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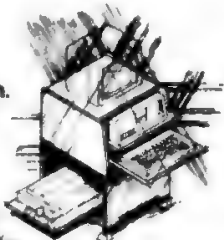
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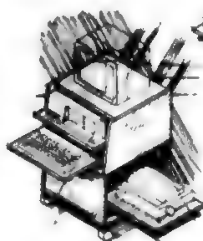
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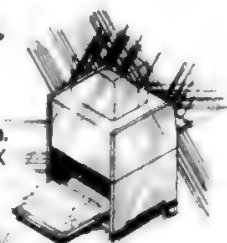
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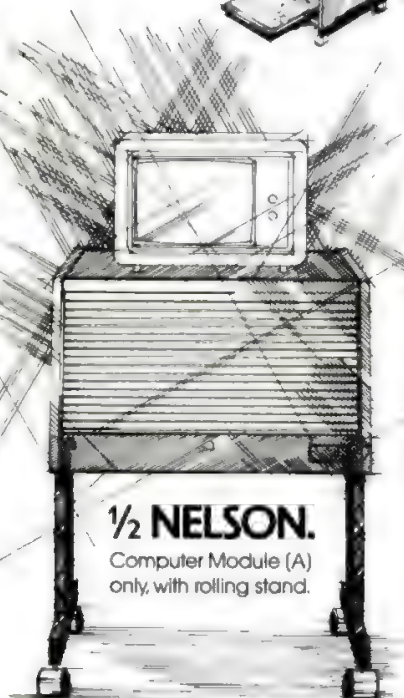
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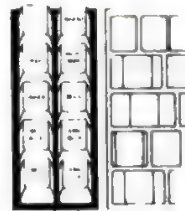
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Taking Care Of Your Trademark

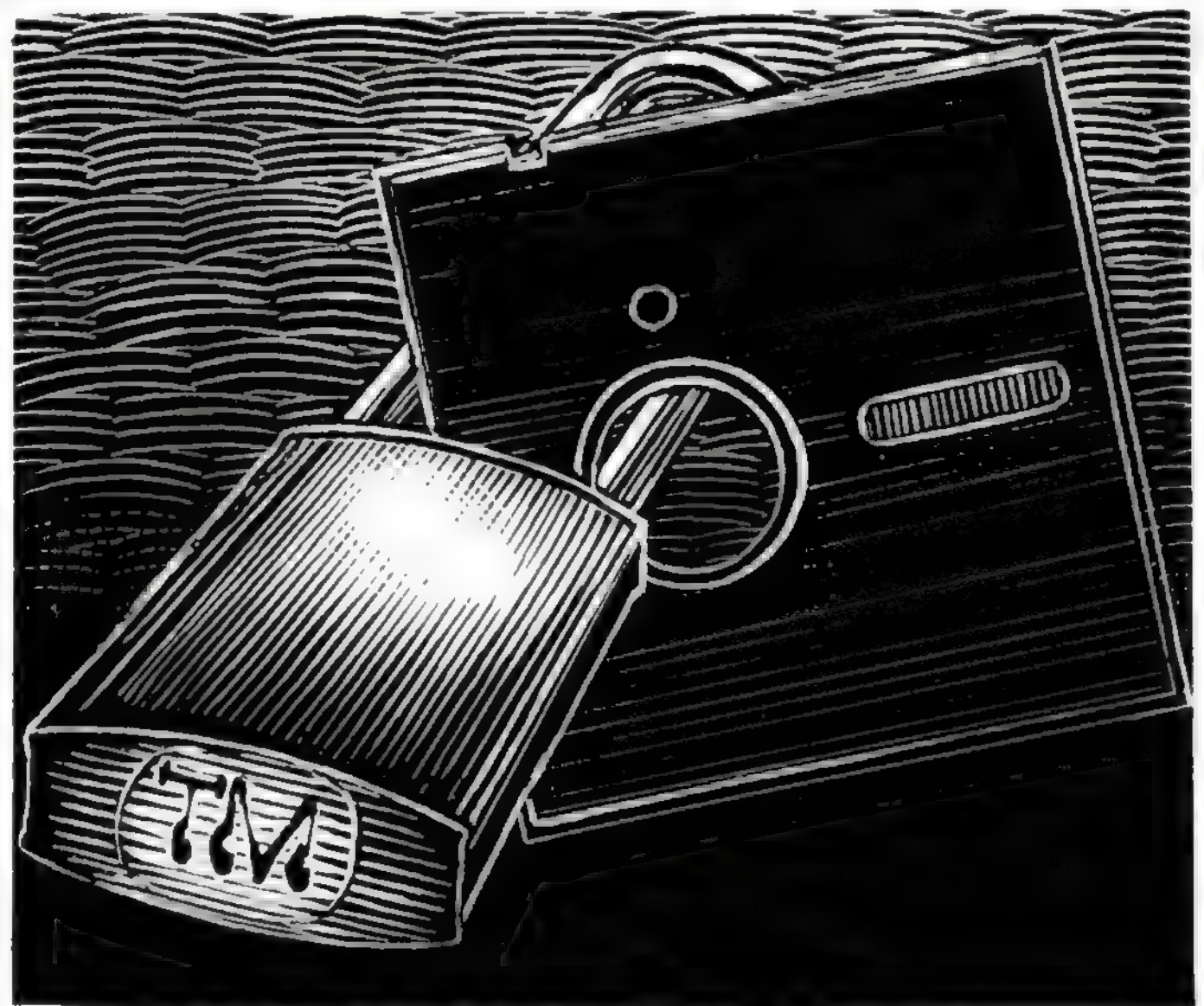
A software program trademark must be properly registered and maintained to ensure legal longevity. Stephen Becker explains the procedures and presents some pointers.

In a previous column, "Putting a Stamp on Your Software," (PC, Volume 3 Number 2), I discussed the criteria for selecting a trademark for a software program. Once this is accomplished, and you have made even a token sale or shipment across a state line, you are eligible to apply for registration. Here, I'll explain the procedures for registering and maintaining your trademark.

Once you've chosen a name, you need to make sure that no one has registered a program in that name. I recommend that you obtain clearance by having an attorney do research at the United States Patent and Trademark Office to determine whether the trademark can be registered by the Federal Government. Try to select an attorney who specializes in trademarks, although most patent attorneys are qualified to do this type of work. You probably can locate such an attorney by contacting your local bar association.

After your trademark attorney has confirmed that the mark can be registered, you must prepare and forward a trademark application to the Patent and Trademark Office, along with a \$175 registration fee and five identical specimens showing how the trademark is applied to your software. Advertisements are unacceptable, since they are not held by the courts to be sufficient evidence of trademark use.

It is also possible to prepare the trade-



mark application yourself. For information on how to do so, contact the Patent and Trademark Office by writing to the Commissioner of Patents and Trademarks, Washington, DC 20231. I recommend, however, that you hire a trademark attorney to do the work for you, because of the inherent technicalities in preparing the application and following it through the procedure.

Registration

A trademark examiner evaluating your proposed trademark will conduct an independent search of the trademark files. The examiner will reject the application if he finds a prior trademark registration that is considered to be similar to yours. When this occurs, which it does surprisingly often, you must be prepared to defend your trademark in order to preserve it.

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If the Patent and Trademark Office examiner accepts your mark, or you are able to successfully argue against the rejection, the mark is published in a weekly booklet entitled, *Official Gazette*, which informs persons who believe that they will be damaged by your trademark registration of what you are doing.

Your registration may be opposed because another party believes that it has superior rights based upon earlier use. Or, your mark may be opposed on the grounds that it is descriptive or generic, or that it has become abandoned due to nonuse. If there is no opposition, or you overcome the opposition, the mark will become federally registered. This registration lasts for 20 years and is renewable any number of times, so long as the mark is still being used by your company.

However, you must file a formal declaration alleging continuous use of the mark between the fifth and sixth years of the registration; otherwise, the registration will be automatically cancelled. Once the declaration is filed, though, the registration is considered "incontestable" and is immune to attack except under special circumstances, which include fraud in procuring the registration, abandonment of the mark, or the case of a mark becoming generic.

Before the mark becomes federally registered, you should add to it the superscript symbol "TM" (or "SM" for a service mark)—for example, *Hypersoft™*. This, of course, stands for "trademark." Although the symbol TM does not provide any substantive trademark rights, it notifies the public that you believe you have trademark rights under common law. After you have registered it, you should use the symbol ® or the words, "Registered in U.S. Patent and Trademark Office," or "Reg. U.S. Pat. & TM Off."

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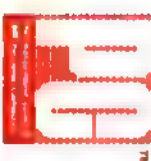


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forfeited whenever the mark loses its significance; that is, when it ceases to indicate the origin of the product. (The same test is applied by state courts to unregistered trademarks.) A trademark, if used properly, will remain valid, and it will remain the exclusive property of its owner forever.

However, if through improper use, the mark becomes equivalent to the name of a product, the trademark becomes lost. The term *escalator* is an example of a trademark that lost its distinctiveness through improper use. Although it had been an effective trademark for over 50 years, the industry began referring to moving stairs as escalators, and eventually the term became more closely associated with a type of moving stairs than with a brand of moving stairs.

Sidney A. Diamond, in his excellent article "How to Use a Trademark Properly" (*Executive Newsletter* #38, United States Trademark Association, 6 East 45 St., New York, NY 10017), outlines five rules for proper trademark use.

- **Rule 1: Use the product's generic name with the trademark.** For example, refer to an IBM computer or an IBM PC, not merely an "IBM." Of course, it is permissible to describe a computer as "made by IBM" or to use similar language. If a trademark is used properly in a sentence and you remove it, the sentence will still make sense.

- **Rule 2: Trademark Notice.** To ensure that the public recognizes your mark as a trademark, the federal statute provides three alternative types of identification to show that the trademark is federally registered. You may use, "Registered in U.S. Patent and Trademark Office" or the abbreviated version, "Reg. U.S. Pat. & TM Off." The third, and perhaps most common marking is the registered sign (®). Be sure that you use any of these markings only if your trademark is federally registered. If not, use the symbol TM as a superscript to the trademark. Although the symbol TM will not provide any substantive rights, it will notify the

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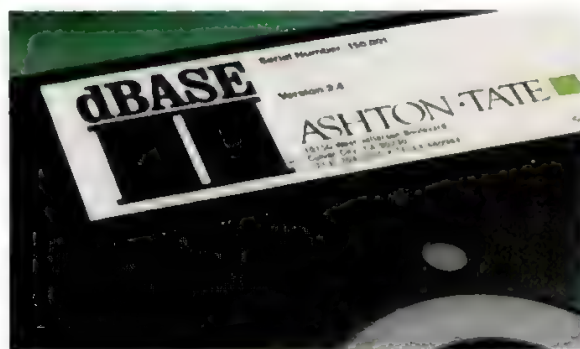
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● **Rule 3: Special Type.** Another technique to ensure that a trademark will be distinctive is to use a unique typographical treatment. An example (again) is IBM.

The trademark may, for example, appear in all uppercase letters, in quotation marks, may be hand lettered, framed, displayed on an unusual background, or distinctively colored. Although the trademark can continue to be modernized typographically, it should not be revised too frequently, as this would blur commercial impression in the minds of consumers.

● **Rule 4: Avoid incorrect grammatical use.** Do not use the mark in the plural form, because this suggests it is a noun. Do not, for example, speak of a room full of "IBMs." Also, avoid using the trademark as a verb. Do not "IBM" your office; instead, install several IBM PCs in your office.

● **Rule 5: Avoid variations.** Do not vary the trademark by changing the spelling, inserting or deleting hyphens, splitting the mark into two words, or combining two words into the mark. If you continually change the form of the trademark, you will detract from its status by suggesting that it is simply another evolving word in the language. If your trademark is Sofstate, for example, don't refer to widespread application of your program as a "Sofstation."

Most importantly, build a strong advertising campaign for your trademark to help it gain distinction. If you see your mark being abused by another company or person, inform the offender immediately by letter and ask him to stop. Because policing your trademark requires educating the public as to its correct use, you should include in your letter the proper way to identify the product. This way future public use will enhance, not dilute, the strength of your trademark. ■

Stephen A. Becker is a patent attorney with the law firm of Lowe, King, Price & Becker, in Arlington, Virginia.

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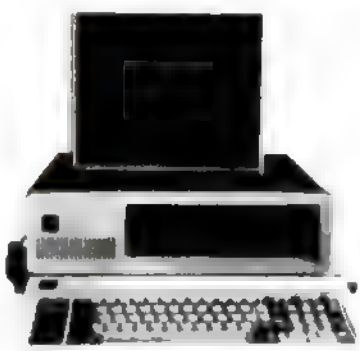
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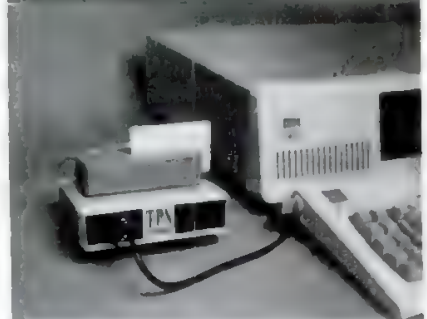
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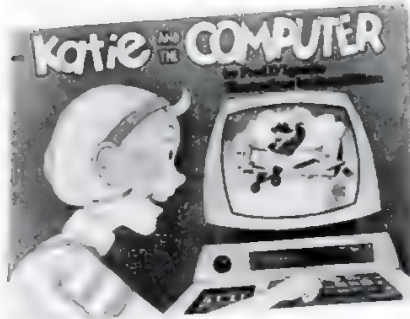


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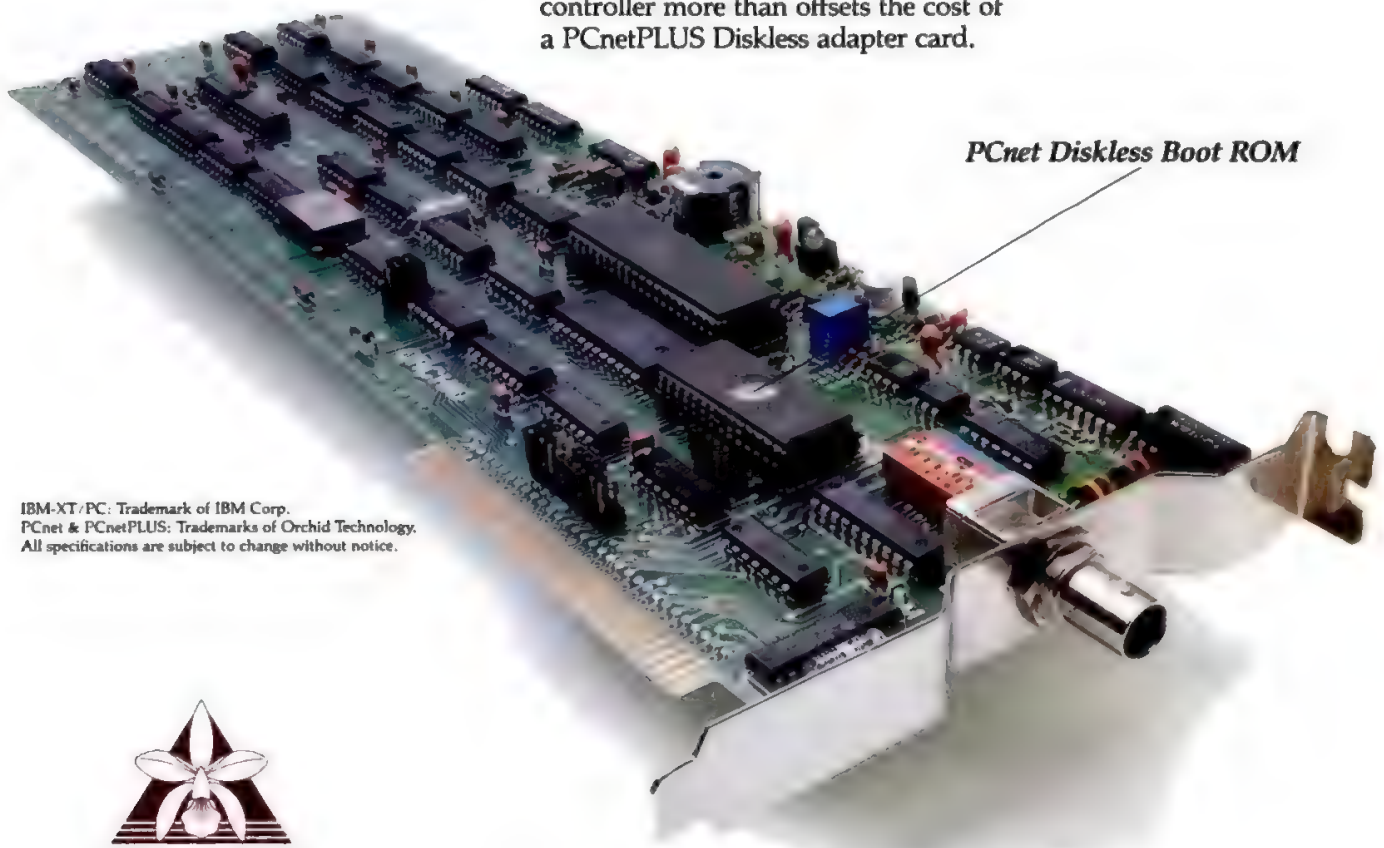
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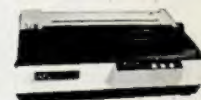
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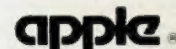
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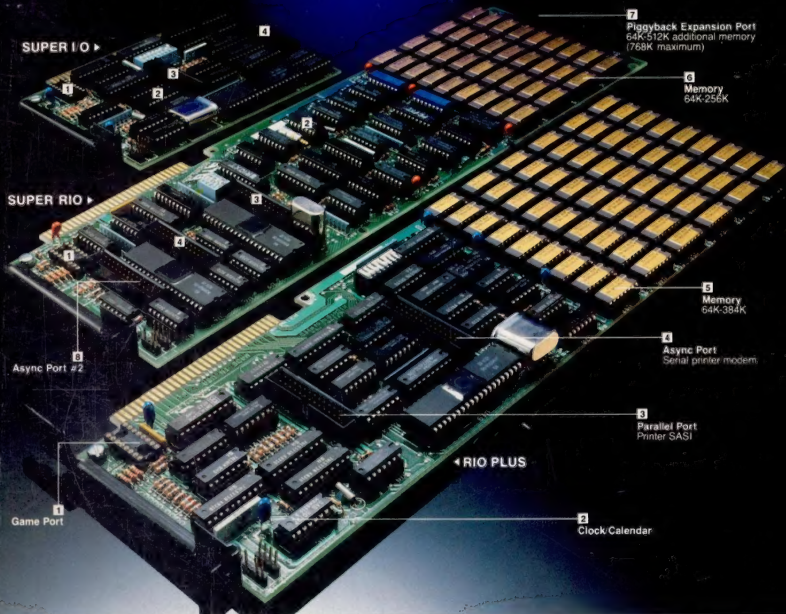
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